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Higher Newsprint Price Is Being Discussed

WPB and Canadian Newsprint Administrator Reported Considering Possibility of Establishing a Basic Rate of $10 Per Ton Higher Than Current Price—Consumption is Down—Other Late News.

[FROM OUR REGULAR CORRESPONDENT]

MONTREAL, Que., December 21, 1942—Following the recent conference with the War Production Board in Washington of R. L. Weldon, Canadian Newsprint Administrator, and other Canadian officials, it is unofficially stated in Ottawa that discussions on an increased price for newsprint are now being conducted with the possibility that basic rate $10 per ton higher will be established. This step is believed to be preliminary to the promulgation of a plan for drastic rationing of newsprint.

Prices of standard newsprint have been unchanged since April 1, 1938, in the United States, although Canadian newsprint mills posted an increase to $53 earlier this year. The United State Office of Price Administration issued a regulation in April this year make a $50 a ton ceiling mandatory for purchases in that country but announced that this action did not preclude further discussions with the Canadian Prices Board on possible increases.

In considering a possible upward adjustment of the price, it was understood that authorities have taken into account the Dominion's manpower and water power contribution to the war effort. Steps to conserve labor and power in the newsprint industry are being taken and mill operating costs have increased.

Canadian mills supply 75% of the paper on which United States newspapers are printed, and any hoist in newsprint prices would come only after consultation between authorities of both countries, it was said.

Newsprint Consumption Down

According to the Newsprint Association of Canada, total apparent consumption of newsprint by all United States publishers amounted to 347,468 tons in November, which was 4,464 tons or 1.3% lower than in November last year, compared with a corresponding decrease of 3.1% in October. The cumulative decrease for the first 11 months of this year was 3.4%. The Association further states that last month newspaper advertising linage in 52 United States cities decreased 1.2% from November of last year, compared with a corresponding decrease of 5.2% in October. The cumulative decrease for the first 11 months of this year over the same period last year was 5.6%. Magazine advertising linage in November increased 1.9% over November, 1941, but the cumulative decrease for the first 11 months of this year was 6.4%. Billings of the three major radio networks for the first 9 months of this year were 8.8% higher than in the comparable period of 1941.

Further Newsprint Rationing in Australia

According to L. M. Cosgrave, Canadian Trade Commissioner at Sydney, a further reduction in the use of newsprint throughout Australia has been found necessary in view of continued shipping difficulties and, as from November 1, a reduction of 15% from the present permitted consumption of newsprint was to come into effect, applicable to metropolitan and country daily and weekly publications. Although the new regulation has been issued as a Commonwealth Order, the leading metropolitan newspapers had to a large extent voluntarily introduced a similar restriction recently to conserve newsprint stocks in the main Australian centers.

In a report submitted to the Australian Minister for Trade and Customs, it was indicated that imported newsprint stocks, plus domestic products amounted to approximately sixteen months' requirements, as from October 1, 1942, on the present rationing basis. No newspaper however will be reduced below four broadsheet pages or their equivalent.

The Government further announced that newspaper proprietors would be permitted to form a pool on the understanding that the requirements of all newspapers are met to the extent of their authorized quota of newsprint and that a suitable undertaking to that effect is given by all members of the pool. The price of newsprint supplied by the pool will be fixed periodically by the Commonwealth Prices Commissioner.

The Swedish Pulp and Paper Industry

A dispatch just received here from Stockholm, Sweden, says:

"The increase in the output of the Swedish pulp and paper mills in the course of this year has been

(Continued on page 27)

Backlog Orders Mounting in Midwest Area

Heavy Orders Create a Strong Paper Market But Doubt is Felt As to Future Delivery of Quantity Desired—Milk Carton Fight Continues—Salesmen Ready For Christmas Party—Other Late News.

[FROM OUR REGULAR CORRESPONDENT]

CHICAGO, Ill., December 21, 1942—The paper industry began to wind up the year 1942 with a back log of orders highly significant of the volatile condition of the paper market. It likewise faced a 1943 with grave fears concerning the curtailment order and with concern as to whether or not the paper industry, in company with all business, could survive the mass of orders and regimentation now in effect. Outwardly, the general market looked good as orders piled in. But there were sales executives and jobber leaders here who regretted the trend as indicating that the "future well of orders" was being dried up by hysteria buying. Nevertheless, all markets developed a very strong tone. Krafts were in excellent demand with an increasing back-log, according to reports. Sulphite markets reported around a 25 to 20% order back-log while books were said to be exceptionally strong with covers also in good demand. Ground woods and newsprints were running very firm with buyers anxious to make commitments far in 1943. Specialties were firm and waste papers, as well, indicated the general firmness of the market by their own strong tone.

Possible Tax Savings Ahead For Industry

Illinois employers are looking forward to the beginning of experience rating in 1943 in connection with the State unemployment insurance act. 1942 completed the third calendar year of benefit payments under the act and the State has already begun to make the necessary calculations to determine the 1943 tax rate for each Illinois employer. On or about March 20 these employers will receive statements showing the new rates and it is understood that the great majority of Illinois taxpayers will get tax rate reductions from the normal 2.7% of payroll. The statement will show the 1943 tax rate, benefit wage ratio and the state experience factor. By applying the benefit wage ratio against the state experience factor, the state determines the tax ratio employers are to pay during the calendar year 1943. It is indicated that paper jobbers, sales offices and allied industries which have a fairly small employee turnover or which have developed personnel policies to take full advantage of the experience rating factor will receive a genuine "break" in taxes—possible as much as $200 for each $10,000 payroll—in 1943.

Milk Carton Controversy Continues

The squabble over paper milk cartons is not over yet. Full page advertisements, editorials and long news comments charging "politics" and "interference" have added to the publicity given paper milk cartons and this week the city decided to appeal its fight directly to the Illinois Supreme Court as the circuit judge entered a final decree on the permanent injunction restraining the city from interfering with milk distribution in cartons. The case was certified directly to the Supreme Court on a question of the validity of a 1935 ordinance requiring that milk be sold in "standard conttainers." A hearing is expected in the March term of court and perhaps by May the five year long debate may actually be over!

E. L. Todd to Direct B & P Sales

The sales efforts of the Bermingham & Prosser Company are henceforth to be directed by E. L. Todd, who has been recently promoted to the position of sales manager of that company. Mr. Todd has been with the well known jobber firm for six years, two of them in the Kansas City division of the organization. He has an excellent background which permits a thorough understanding of the problems of B & P customers, having had experience in both the newspaper and periodical publishing fields. Mr. Todd is known as "Gene" to the paper trade in this area.

Kankakee Paper Co. Expands

From Kankakee, Illinois, comes the news that the Kankakee Paper Company has recently expanded its activities to include branch office and warehouse headquarters in LaPorte, Indiana, a busy manufacturing city about 90 miles from Chicago. The president of the company, D. E. Cooper, indicates that the branch division will also handle bags, towels, tissues, gummed tape and a line of spcialties.

Salesmen Ready for Christmas Party

The western division of the Salesmen's Association of the Paper Industry has completed plans for its annual Christmas party to be held at the Hotel Sherman on December 21. 'Ben Babbitt will again serve as toastmaster and "major domo" of the noon entertainment event while it is expected that Jim Coy of Flambeau Paper Company will again do his best to get some hilarious singing under way. War conditions have caused the SAPEYES to trim their entertainment budget a bit but the two old standbys of past years will again be present—Harry Kerr and Harold Pfister. This duo-piano team is a fixture with the salesmen and the presence of these two accommodating chaps already guarantees the success of the annual party.

Protection of War Shipments

Shippers of items ranging from tomatoes to trainer planes will be interested in current issue (No. 9) of Acme Process News. This 12 page house organ of Acme Steel Company reveals how many types of war and civilan products are protected in transit for safe arrival at far flung destination. Life rafts, paper, metal parts, landing field mats, planes, food products, tractors, machine guns and orange juice are some of the shipments which are included in the present issue. Copies are available from Acme Steel Company. 2840 Archer avenue, Chicago.

Wisconsin Merchants Discuss Paper Cut

Problems Arising From Reduction in Paper Production and Revision of Sales Programs Considered at Milwaukee Meeting—Progress of Waste Sulphite Liquor Disposal is Reviewed—Other News.

[FROM OUR REGULAR CORRESPONDENT]

APPLETON, Wis., December 21, 1942—Problems connected with curtailment of paper production were discussed at a meeting of 35 members of the Wisconsin Paper Merchants Association December 14 at the Wisconsin Hotel, Milwaukee, Wis. L. E. Stevens, Milwaukee, president, was in charge.

Revamping of sales programs was urged to take care of the shortages incident to reduced production under government orders, with study being given to lines which are the most readily available. The manufacturing situation also was considered, with respect to the shortage of woodsmen to cut timber, and the congestion of transportation facilities.

Review Progress of Waste Liquor Disposal

Progress made in recent weeks by the researchers on sulphite waste disposal was reviewed by the Wisconsin Sulphite Pulp Manufacturers committee at a meeting at Appleton, Wis., December 15. The session was held at the Institute of Paper Chemistry, which has its staff working on the project.

Processes being developed to salvage waste on a commercial basis as a means of eliminating river pollution were reviewed, including some tried elsewhere in the country. A report also was made on the experimental plant being established at the Interlake Pulp and Paper Company division of Consolidated Water Power and Paper Company at Appleton.

Badger Mills Distributes $100 Bonus

Christmas bonuses of $100 each have been given to employees of the Badger Tissue Mills, Kaukauna, Wis. The distribution went to forty workers, according to L. F. Nelson, president.

Mills Hold Union Elections

Union elections have taken place during the last week in various mills. The Nepco Paper Makers Local No. 59 of the Nekoosa-Edwards Paper Company, Port Edwards, Wis., has a new president, Earl Wellner, who succeeds Gerald Stone, president for the last three years. Edward G. Gilbertson was elected for his 12th term as president of Badger Local 187, International Brotherhood of Papermakers, made up largely of workers of Consolidated Water Power and Paper Company, Wisconsin Rapids, Wis. The Ahdawagam Local 195, Pulp and Sulphite Workers Union, reelected Conrad Booth as president.

The union includes employees of the Ahdawagam Paper Products Co.

Stanton W. Mead Re-elected

Stanton W. Meal, vice-president of the Consolidated Water Power and Paper Company, Wisconsin Rapids, Wis., has been reelected a vice-president of Samoset Council, Boy Scouts of America. He has been active in the organization for a number of years.

Discuss Cut in Chlorine for Paper

[FROM OUR REGULAR CORRESPONDENT]

WASHINGTON, D. C., Dec. 23, 1942—Further reductions of chlorine for paper bleaching, development of paper and paper products for war uses, and the types of paper that require the use of manila fiber and old manila rope were discussed at three recent advisory committee meetings here.

The Pulp and Paper Industry Chlorine Advisory Committee discussed the shortage of chlorine, pointing out that the supply is insufficient to fill even the requirements allowed under Limitation Order L-11. An amendment to the order was suggested that would further reduce the amount of chlorine consumed.

In view of the shortage of manila fiber, the Pulp and Paper Industry Advisory Committee on Manila Fiber and Old Manila Rope attempted to determine essential uses of these fibers in the manufacture of paper. The committee recommended that a questionnaire be sent to companies consuming manila tow or old manila rope, asking each company to submit its estimated requirements for these materials for the manufacture of essential products in 1943. From the questionnaire returns, a list of essential paper products requiring manila tow and old rope would be prepared and referred to the Industry Advisory Committee for further analysis at its January meeting.

The Paper Industry Technical Development Advisory Committee of the War Products Development Section discussed the 25 projects on which the Section is working currently. These deal with ordnance and materials for the Quartermaster Corps, and application of papers impervious to grease, moisture and oils for both military and civilian uses.

Rototrol Drive Control

For use where wide speed range or close regulation is required, the Rototrol, a versatile d-c drive control, is described in a new booklet by Westinghouse Electric and Manufacturing Company.

The new 14-page booklet "A Challenge to Designers of Drive Control" describes how Rototrol increases the speed range; keeps the speed of a direct-current motor constant regardless of load variations; makes accurate or very close speed regulation possible; gives uniform acceleration and deceleration; and maintains constant horsepower and uniform tension.

Charts, diagrams and photographs explain how the Rototrol regulates by transposing mechanical and electrical quantities. Typical applications are described and illustrated First used in the automatic welding head, the Rototrol is now used for a wide range of applications: high-speed elevator, variable voltage planer drives, paper mill drives, mine hoists, steel mill skip hoists, and electric shovels and draglines. A copy of B-3123 may be secured from Department 7-N-20, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa.

Michigan Superintendents Meet

[FROM OUR REGULAR CORRESPONDENT]

KALAMAZOO, Mich., December 21, 1942—The December meeting of the Michigan Division of the American Pulp and Paper Mill Superintendents Association was held at the Park-American Hotel Thursday evening, December 17, with forty attending. Chairman Al Perlick announced that the committee on arrangements for the joint meeting of TAPPI and Superintendents to be held on January 7, 1943, had secured John Strange, director of New Developments in the Pulp and Paper Branch of the WPB, as the speaker.

Ray L. Barton read a telegram from Mrs. Eminger advising that "Bob" was undergoing another operation that day in the Miami Valley Hospital in Dayton. A motion to send flowers and a Christmas message to the genial national secretary, was voted on favorably.

H. G. Specht Speaks

The speaker for this meeting was H. G. Specht, vice president and general manager of Eastwood Nealley Corporation, who showed some very interesting slides illustrating the new process of centrifugal casting of phosphorus bronze in connection with the manufacture of Fourdrinier wires. He commented on several points in connection with the paper industry, one being that a paper mill cannot be utilized for any other purpose than the manufacturing of paper and at the conclusion of hostilities the plants would still be intact. Also that paper is one of the fastest products made in the industrial field. Paper stock leaving the lead box on a machine running 1200 F.P.M. leaves the calendar stock in less than 30 seconds in finished form. As a contrast, Mr. Specht stated, Fourdinier wires represent a very slow process of manufacture, the time lapse between the receipt of the raw material and the finished wire is from four to six months. Addltional slides showed the process of the manufacture of the drawn wire and the weaving of the wire into the final form represented by the finished Fourdinier wire.

Another part of Mr. Specht's address was devoted to a discussion of the General Limitation order L-209 issued by the WPB. His expressed opinion was that this order would not make any major change in the present method of handling paper mill wires and indicated that it would improve the control of inventories and the present handling of wire orders. Also it was necessary for mills to plan their wire requirements six months in advance and place firm orders for them with the wire manufacturers in accordance with a delivery schedule. This schedule should so arrange the shipment of the wire to the paper mill as to maintain a four wire inventory for each machine at all times.

Mr. Specht concluded his address with the request that every paper mill give serious consideration to the plan outlined in Limitations Order L-209 which if followed would reduce mill inventories and Fourdinier wire manufacturer's inventories to a minimum, consequently serving the needs of the WPB and the Government in the economical use of critical materials.

Those in Attendance

The following attended the meeting: Ralph Atkins, Lee Paper Company; Kenneth Adams, Kalamazoo Vegetable Parchment Company; A. W. Ayles, American Cyanamid Corporation; R. P. Abercrombie, Cheney Bigelow Wire Works; W. H. Astle, Michigan Paper Company; P. W. Bartholomew and Robert Buss, Hercules Powder Company; R. L. Barton, Michigan Paper Company; S. V. Cottrell, Allied Chemical and Dye Corporation; A. H. Crouch, Lee Paper Company; A. W. Cole, Rex Paper Company; W. J. Cassidy, Hawthorne Paper Company; A. G. Dreis, Hercules Powder Company; J. A. Dean, Michigan Paper Company; F. B. Eilers, Eastwood-Neally Corporation; Merton S. Fogerty, Michigan Paper Company; L. L. Griffiths, Williams-Gray Company; C. F. Hoelderle, Anheiser-Busch, Inc.; Fred Hodgemire, Hawthorne Paper Company; J. A. Heenan, Sutherland Paper Company; R. W. Howerton, Heller & Merz; Lester H. Laliberte, Kalamazoo Vegetable Parchment Company; Howard Merkle, Sutherland Paper Company; J. W. McClaren, National Starch Products; Henry Nendorf, Rex Paper Company; A. L. Perlick and George H. Rice, Kalamazoo Vegetable Parchment Company; A. W. Riedel, Riedel Brush Company; W. S. Taylor, American Cyanamid Corporation; Glen Sutton, Sutherland Paper Company; Harry G. Specht, Eastwood-Neally Corporation; A. L. Sherwood, Sutherland Paper Company; D. B. Snedeker and W. L. Shaw, Heller & Merz; H. E. Stafford, Retired; Richard Tielfa and H. O. Ware, Hercules Powder Company; Arnold Weller, Sutherland Paper Company, and Joe Waber, Rex Paper Company.

Young Chemist Honored

Loren Dickerson, a member of the staff of Arthur D. Little, Inc., consultants on industrial research in Cambridge, Mass., was included in such distinguished company as Bernard M. Baruch, Carter Glass, William Lyon Phelps, and William Allen White as one of the 28 new members recently (Nov. 10) elected to membership in the 200 Associates of Phi Beta Kappa, the national scholastic honorary society. The Associates were formed in 1940 to lead Phi Beta Kappa, which now has over 90,000 members, into a more active participation in present world affairs. The group, which is limited to 200, includes Lincoln Filene, Charles Evans Hughes, Hans V. Kaltenborn, Roscoe Pound, Nelson A. Rockefeller, and Theodore Roosevelt.

Mr. Dickerson, who is 24, is the youngest member of the Associates and the only industrial chemist in the group. He received a Bachelor of Science degree from Emory University, Atlanta, Georgia, and will soon receive a Doctor of Science degree from Massachusetts Institute of Technology, where he studied a phase of fluid flow now used in research by the armed services.

Mr. Dickerson is now engaged in chemical engineering research on war production facilities for Arthur D. Little, Inc.

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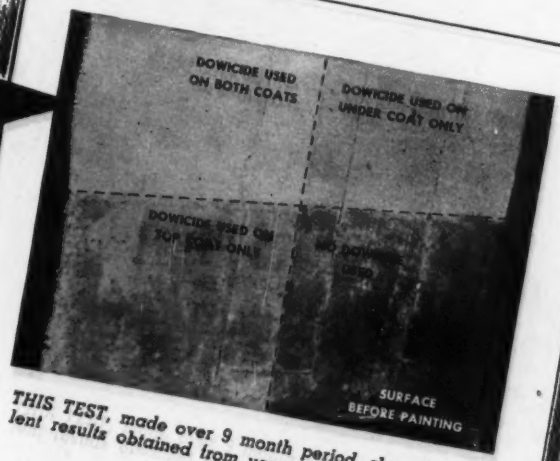

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Obituary

Mendel Gottesman

Mendel Gottesman passed away on Wednesday, December 16, at Mount Sinai Hospital, New York, after a brief illness. His age was 83.

Mr. Gottesman, a pioneer in the wood pulp and paper industry, founded the firm of M. Gottesman & Son in 1886, predecessor of Gottesman & Company, Inc. He also founded the Hudson Trading Corporation and the Credit Utility Banking Corporation, of which he was president at the time of his death.

MENDEL GOTTESMAN

Mr. Gottesman, whose benefactions were notable, devoted considerable time to educational and charitable endeavors. He served as treasurer of Yeshiva College for a number of years and as president of the Yeshiva Endowment Foundation succeeded in raising considerable funds for that institution. He also created the Mendel Gottesman Library in that institution.

In 1917 he organized the Gottesman Tree of Life Foundation through which his manifold welfare activities were carried on. Mr. Gottesman was a generous contributor to a wide number of charities.

He leaves four sons, D. Samuel, Saul, Benjamin, and Herman Gottesman, and a daughter, Mrs. Helen Borgenicht. His wife predeceased him in 1931.

Roger Williams

Roger Williams, 68, widely known in the paper industry, particularly among manufacturers, to whom he sold paper felts, manufactured by his company, died December 14 at his home in Canton, Mass.

Mr. Williams was treasurer and director of Draper Bros. Company, woolen manufacturers of Canton, a member of the board of investment at Canton Institution for Savings, and a director of Richard Briggs China Company, Boston.

For many years he had served as chairman of the board of trustees at Canton Public Library. Until recently he was a charter member of the board of governors of the Scituate Country Club, and a member of the board of governors of Scituate Yacht Club.

Born in Canton, the son of William John and Mira Elizabeth (Draper) Williams, he was graduated from Technology in 1895, and entered the business established by his grandfather in Canton.

He leaves his widow, Jeannette Wild Williams; two sisters, the Misses Annie and Helen Williams, of Canton; three sons, Roger Williams, Jr., and Eugene Williams, both of Canton, and William John Williams, of the Army, and three grandchildren, Mira Elizabeth, Roger, and Peter Williams.

Funeral services were private.

Charles McDowell

[FROM OUR REGULAR CORRESPONDENT]

PHILADELPHIA, Pa., December 21, 1942—Charles McDowell, prominently connected with the paper industry for a long number of years until his retirement a few years ago, died yesterday after a heart attack in his home, 5804 Green street, Germantown. He was aged 76 years.

Mr. McDowell sold the McDowell Paper Mills at Manayunk, which had been operated by him and his family over a long period of time to the Glassine Paper Company in October, 1939.

The survivors include a sister, Mrs. Rebecca Morris, and two brothers, Frank and Joseph McDowell.

He was a member of the Union League, the Germantown Cricket Club, Franklin Institute, Pennsylvania Museum of the University of Pennsylvania, and the University Lodge, F. & A. M. He was given a life membership in the Academy of Natural Sciences and the Zoological Society of Philadelphia. Interment was in Mt. Vernon Cemetery.

Samuel R. Armstrong

Samuel R. Armstrong of Caledonia, N. Y., former vice president and general manager of the New York and Pennsylvania Company, died December 12 of a heart ailment in his winter home in Vero Beach, Fla., according to word received here. He was 68.

In 1916 he built the plant of the Mattagami Pulp and Paper Company at Smooth Rock Falls, Ont., and became general manager there. Subsequently he was technical adviser at the Abitibi Power and Paper Company plant at Iroquois Falls, Ont. For many years he was president of the First National Bank of Caledonia, N. Y. He retired eight years ago.

He leaves a widow, a son, Calvin Leroy Armstrong; two daughters, Mrs. Dorothy Thiede and Mrs. Philip Clement, and two sisters, Mrs. John C. McIntire and Mrs. William E. Bevan.

George Parent

[FROM OUR REGULAR CORRESPONDENT]

MONTREAL, December 14, 1942—Senator George Parent of Quebec, Speaker of the Canadian Senate, died today while on a business trip here. His age was 62. He was the son of the late S. N. Parent, former Premier of Quebec Province and for twelve years Mayor of Quebec.

A director of Le Soleil, Ltd., he was president of Citadel Brick, Ltd., vice president of the Donnacona Paper Company and a director of the Quebec Power Company, Southern Canada Power Company and the Eastern Canada Steel and Iron Works.

He married Miss Kathleen Grenier in 1912. Two sons were born to them.

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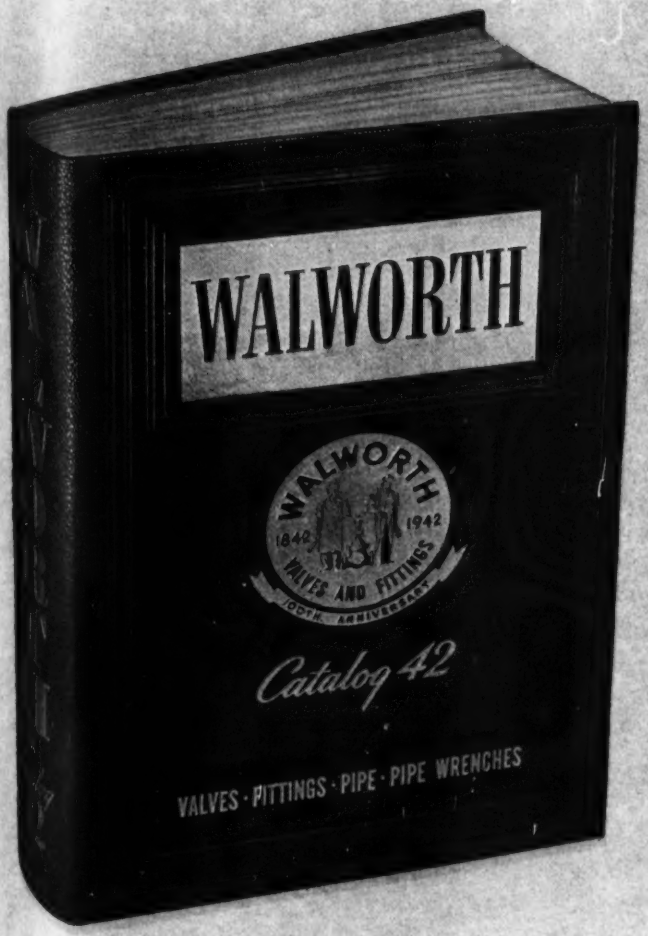

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Instrumentation Studies XLI*

Measurement of the Tensile Strength of Paper

Part II: The Scott Serigraph, Model J3

By the Staff of The Institute of Paper Chemistry

Abstract

The Henry L. Scott Company Model J3 tensile tester is described. The particular instrument studied is in error at a number of points along its scale. For many applications to control testing this error is not serious. For many other applications it is serious. In addition, friction causes errors of as much as 1.3 pounds. Neither source of error is due to faults in fundamental design and both could be eliminated by the manufacturer.

The Henry L. Scott Company of Providence, Rhode Island, manufactures several models of tensile testers which it recommends for testing the tensile strength of paper. These testers are of two types, namely, the inclined plane type and the pendulum type. This report describes an investigation of the Serigraph (Model J3), which is one of the pendulum-type testers. Although only this one instrument was examined, it seems probable that the general conclusions are applicable to all the Scott pendulum-type tensile testers.

Since Part I of this series (Instrumentation Studies XL *(1)*) contains a general discussion of tensile strength testing of paper, this part deals only with the characteristics of this particular instrument. Although the instrument is equipped with a recording device for tracing load-elongation curves, by which stretch values may be obtained, this feature of the instrument will not be discussed until a more thorough investigation of the general subject of stretch measurement has been made.

A photograph of the instrument is given in Fig. 1. The instrument is of the pendulum type and has two ranges, 0 to 55 pounds, and 0 to 110 pounds, with scales graduated in half pounds and pounds, respectively. The lower range is effective when only the fixed weight is used on the pendulum and the higher range is effective when an auxiliary weight is added to the pendulum. The tensile scales are marked on a circular dial whose indicator is coupled to the pendulum through gears. The lower clamp is fastened to a threaded rod which is motor driven through a gear box and a variable speed pulley. The speed of this lower clamp may be varied continuously from 3 to 20 inches per minute. The upper clamp is connected to the pendulum by a chain passing around and anchored to a pulley which in turn is fastened to the pendulum and is coaxial with the bearing of the pendulum. The jaws are equipped with interchangeable anvils of 1- and 3-inch widths.

The instrument is equipped with a recording mechanism for tracing load-elongation curves. The chart carriage is drawn downwards by a gear train coupled to the lower clamp, thus assuring that the chart moves at speed proportional to the speed of the lower jaw. The pen carriage moves horizontally and is connected to the pendulum by a rod.

The instrument was levelled when it was mounted on the wall. The first step in the calibration of the instrument was the adjustment of the zero position of the indicator. The recording mechanism was disconnected. The pawls were raised and the pendulum allowed to come to its equilibrium position while the instrument was tapped to eliminate the effects of

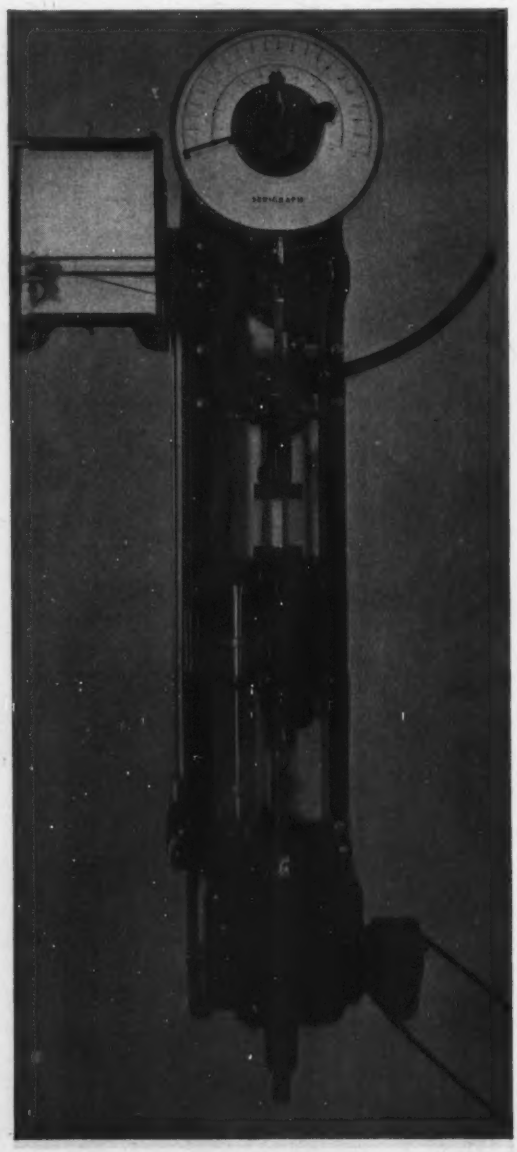

FIG. 1
The Scott Serigraph, Model J3

* This report is one of a series issued as a part of the instrumentation program of the American Paper and Pulp Association.

friction. The pointer was loosened on its shaft, rotated to coincide with the zero position of the scale, and tightened.

The second step in the calibration consisted in checking a number of points on the scale by dead-weight loading. The lower clamp was drawn down out of the way and, with the pawls still raised, known weights were fastened in the upper clamp. The scale readings corresponding to these known weights were obtained by allowing the pendulum to come to its equilibrium position while the instrument was tapped to eliminate the effects of friction.

This technique of dead-weight loading differs from that recommended in the Scott Company Bulletin GG on the care and calibration of tensile testers from which the following quotation is made:

"Allow the weight to exert its force by lowering gradually by hand. Do not drop it, but do not work too slow. The proper speed is the speed at which the stress is applied when actually making a test. The pointer should register upon the dial the exact amount of the weight used plus the mechanism used for holding same.

"Care must be used to see that the pawls are in the same position on the quadrant racks as in an actual test, and that the weight used is so attached that there will be no binding or friction interposed that will prevent the full force being registered upon the dial."

In view of the discussion of calibration presented in Part I of this series *(1)* there appears to be no reason for using the Scott technique, since it was shown that true dead-weight loading constitutes the proper method of calibration.

Figure 2 shows the correction curve thus obtained for the instrument. The difference obtained by subtracting the scale reading from the actual value of the load is called the correction and is plotted along the vertical axis; the actual scale reading is plotted along the horizontal axis.

With this correction curve in mind one must question the statement in the last paragraph of the Scott Company Bulletin GG which states:

"Every machine is carefully inspected and calibrated before leaving our factory and it is safe to assume that accuracy at any one point of the dial indicates a correct machine at all points. This may be substantiated by a second test with a weight of different amount."

It is somewhat difficult to determine the seriousness of these errors as regards the testing of paper. Errors as great as the 9% error at a reading near 10 pounds on the large scale and the 8% error at a reading near five pounds on the small scale are unquestionably objectionable. The seriousness of errors of the order of 1% must be judged in terms of the precision customarily obtained or desired in the tensile strength testing of paper. The solid straight lines of Fig. 2 are so drawn that all points belonging to the 0-110-pound scale which fall between the lines indicate an error of 1% or less. The dashed straight lines are correspondingly drawn for the 0-55-pound scale, and they also limit the region in which the large scale is in error by 0.5 per cent or less. Tests previously reported (Instrumentation Studies XXIV *(2)*) indicate that the average percentage probable error in the mean of 10 measurements of tensile strength for each of 11 papers of bond, ledger, and mimeo grade is approximately 2.1%, with the values for individual papers ranging from 0.54 to 6.77%. Assuming this value of 2.1% to be the percentage probable error to be expected in the average of a group of 10 observations of tensile strength, instrumental errors of the order of 1% do not, at first glance, appear unduly objectionable. However, a control instrument, and certainly a research instrument, should measure a property with more precision than that property can be controlled in the manufacturing process. On this basis, many of the instrumental errors shown in Fig. 2 seem larger than desirable. Of course, a correction curve similar to that in Fig. 2 can be used to correct readings obtained with the instrument. In routine testing, however, a correction curve is a nuisance.

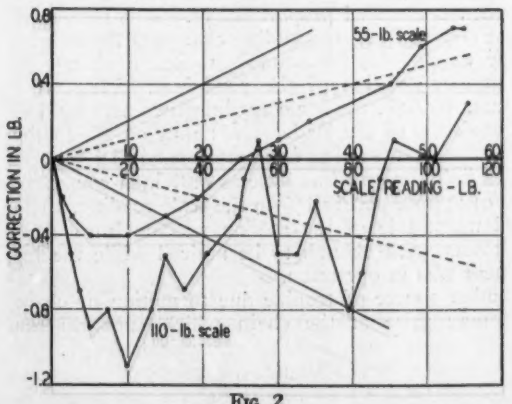

FIG. 2
Correction Curve

The erratic nature of this correction curve suggested that the accuracy of subdivision of the scale be tested. Since the pointer of this scale is gear-coupled to the pendulum, any angular displacement of the pointer is proportional to the corresponding angular displacement of the pendulum. In Part I of this report it was shown that the load applied to the upper clamp is proportional to the sine of the angle between the unloaded and the loaded positions of the pendulum. The relationship between scale division and the corresponding changes in load may best be described in the following mathematical fashion: The proportionality of the angle, Φ, through which the pointer turns to the angle, θ, through which the pendulum turns is given by Equation 1:

$$\Phi = G\theta, \tag{1}$$

in which G is a proportionality constant. The relationship between load, T, and angular displacement of the pendulum is given by Equation 2:

$$T = C \sin \theta, \tag{2}$$

in which C is a proportionality constant. If the load is changed from a value T to a value ΔT greater—i.e., to a total load of $T + \Delta T$—the angle of the pendulum will change from θ to $\theta + \Delta\theta$, and the relationship corresponding to Equation 2 is given by Equation 3:

$$T + \Delta T = C \sin (\theta + \Delta\theta). \tag{3}$$

By further use of trigonometry, we may replace $\sin (\theta + \Delta\theta)$ by $\sin \theta \cdot \cos \Delta\theta + \cos \theta \cdot \sin \Delta\theta$. Equation 3 thus becomes Equation 4:

$$T + \Delta T = C (\sin \theta \cos \Delta\theta + \cos \theta \sin \Delta\theta). \tag{4}$$

If the change in load ΔT is small, the change in angle $\Delta\theta$ will also be small. It will be remembered that for small angles the cosine is approximately unity and the sine is approximately equal to the angle expressed in radians. Hence, in Equation 4, $\cos \Delta\theta$ may be replaced by unity and $\sin \Delta\theta$ may be replaced by $\Delta\theta$ if only small changes in load are considered. Equation 4 may then be written as Equation 5:

$$T + \Delta T = C (\sin \theta + \Delta\theta \cos \theta). \tag{5}$$

If Equation 2 is subtracted from Equation 5, Equation 6 results:

$$\Delta T = C \Delta\theta \cos \theta. \tag{6}$$

From Equation 1, it will be seen that when θ changes by a small amount $\Delta\theta$, Φ will change by a small

amount $\Delta\Phi$. This relationship may be expressed by Equation 7:

$$\Delta\Phi = G \cdot \Delta\Theta. \quad (7)$$

If $\Delta\Theta$ in Equation 6 is now replaced by its equivalent from Equation 7, namely, $\Delta\Phi/G$, Equation 8 results:

$$\Delta T = (C\ \Delta\Phi \cos\Theta)/G. \quad (8)$$

This equation means that when a given load, T, is applied to the upper clamp and the pendulum is deflected through an angle Θ, a small change in the load, ΔT, will cause a small change in the angle of the pendulum, $\Delta\Theta$, which, because of the coupling of the pointer to the pendulum will cause a change $\Delta\Phi$ in the angular position of the pointer. The relationship between the angular displacement of the pointer and the linear displacement along the scale is given by Equation 9:

$$\Delta S = a \cdot \Delta\Phi, \quad (9)$$

in which ΔS is the linear displacement along the scale and a is the radius of the scale. Combining Equations 8 and 9 and solving for ΔS, we have Equation 10:

$$\Delta S = (aG/C)\ (\Delta T/\cos\Theta). \quad (10)$$

The quantity (aG/C) is a constant which may be called C' and Equation 10 may be rewritten to have the form of Equation 11:

$$\Delta S = C'\ \Delta T/\cos\Theta. \quad (11)$$

The value of the constant C' in Equation 11 may be calculated if the linear displacement of the pointer, ΔS, is measured when the load is changed by an amount ΔT. It must be remembered that this equation was obtained by an approximation and is true only when the change in angle and the corresponding change in load are small.

Measurements were made to permit the calculation of this constant C' for the 0-110-pound scale. Figure 2 shows that the scale of the instrument was correct at a load of 102 pounds. The pendulum was displaced until the pointer registered 102 pounds and the angle which the pendulum made with the vertical was measured and found to be 36.2 degrees. It was also found that the pendulum moved through an angle of approximately 2 degrees when the pointer moved through a scale division corresponding to five pounds. This angle was considered small enough to warrant the use of Equation 11. The distance between the 100- and 105-pound division on the scale was measured with dividers and found to be 1.13 inches. The value of C' was calculated from Equation 11 and found to be 58.0. This value of C' was used to calculate, by means of Equation 11, the values of ΔS for a number of positions along the scale using a five-pound change in load for each calculation—i.e., letting ΔT equal five pounds. The values of the load T corresponding to these angles may be calculated from Equation 2. The value of C is obtained by substituting in this equation the measured values, T equal to 102 pounds and Θ equal to 36.0 degrees. The value of C so found was 172.8; values of T were then calculated for the same positions as those used in the calculation of ΔS. The curve drawn through the solid points plotted in Fig. 3 shows the resulting relationship between ΔS and the load.

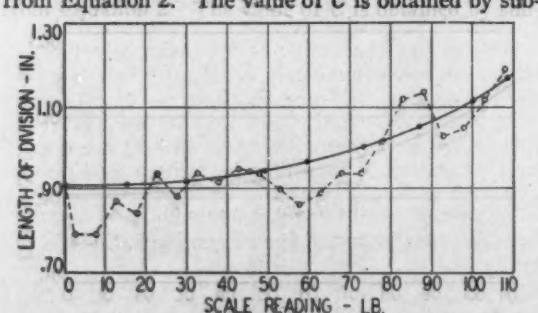

FIG. 3
Relationship Between Length of Scale Division and Scale Reading

The actual distances between five-pound divisions on the scale were measured with dividers and the values are plotted as open circles in Fig. 3. The points are plotted at a value of the load midway between the scale divisions—i.e., the distance between the 100- and the 105-pound division was plotted at 102.5 pounds. The fact that these plotted points do not fall upon a smooth curve indicates that the scale was in error in an erratic fashion. It should be remembered that the calculated points through which the curve is drawn were calculated on the assumption that the scale interval from 100 to 105 pounds was correct. If this interval was not accurate, the curve would be shifted somewhat but would not be changed in its general shape.

If the errors shown in Fig. 2 were all due to inaccuracies in the division of the scale, the general shape of the correction curve for the 0-110-pound scale should be similar to the general shape of the curve through the observed points plotted in Fig. 3. Since this is not exactly the case, some other source of error contributes to the discrepancies shown in Fig. 2.

At least part of this residual error appears to be due to the action of the chain, which supports the upper clamp, as it winds around the pulley. Because of the finite length of the links and because they do not fit the curvature of the pulley exactly, the effective lever arm changes slightly as the chain wraps around the pulley. The length of the links—i.e., the distance between rivets—is 0.375 inch and they touch the pulley only at their ends. The effect of this motion of the links may be explained as follows: Equation 2 was obtained from Part I of this report and C of that equation represents the quantity WR/r. W is the weight of the pendulum, R is the distance between the axis and the center of gravity of the pendulum, and r is the effective radius of the pulley on which the chain winds. This effective radius depends on the position of the chain link as well as on the actual radius of the pulley. Equation 2 is more useful for the present purpose if it is rewritten as Equation 12:

$$Tr = WR \sin\Theta. \quad (12)$$

Due to the action of the links, r changes, and the torque on the pendulum due to the tension in the specimen is changed proportionally. This change in torque requires a corresponding change in the counter torque exerted by the pendulum—i.e., a change in the angular position of the pendulum. Thus, if r increases by 1%, the scale reading increases by 1% independently of the load. The pulley on which the chain winds has a radius of approximately 1.1 inches; thus, a link motion of as little as 0.01 inch causes an error of approximately 1% in the scale reading. The actual magnitude of the motion was not measured, but it was great enough to be noticed while the instrument was in operation.

Another source of trouble due to motion of chain links may arise at the chain which supports the counterpoise at the back of the instrument. This counterpoise serves to balance the weight of the upper clamp and does so by means of a chain which is wrapped around a pulley fastened to the pendulum

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Hercules Adapts Wood Pulp for Powder

WILMINGTON, Del., December 23, 1942—Research of Hercules Powder Company adapting wood pulp for the manufacture of smokeless powder has increased powder production of American, Canadian, and Australian plants, the company disclosed here today. The adaptation of wood pulp for powder manufacture has increased powder output about one quarter wherever it has been used, and freed Canada and Australia from dependence upon cotton, the company said.

Process Credited to Ralph L. Stern

Development of the new powder process was credited to Ralph L. Stern, chemical superintendent at the Parlin plant, whose experimental work on wood cellulose made possible the use of wood pulp for rifle and cannon powders.

The Hercules company has made available the wood pulp development without cost to the governments of United Nations and to all American producers as soon as it had been found effective.

Powder usually is made from cotton. Previous attempts to use wood pulp had resulted in powder of uncertain quality and the process was slow and expensive.

Research Begun in 1934

Research begun by Hercules in 1934 and carried on since then has saved time and money in the war program. Experiments at the Parlin laboratory, leading to the adaptation of wood pulp, resulted not only in the use of pulp but also in the increase in output.

When the War and Navy Departments' requirements for smokeless powder were presented, it became apparent that supplies of cotton would be entirely inadequate for the war program, the Hercules statement said.

The Hercules Statement

"To facilitate ease of manufacture and hold costs down, Hercules sought a process which could utilize the commercial grades of wood pulp such as those used in rayon manufacture, which were then being produced by existing wood pulp plants. For this purpose it was imperative also that the wood pulp should function in nitrocellulose plants designed for the manufacture of nitrocellulose from cotton.

"If this could be accomplished, no alterations in the plant process would be required and it would eliminate special plant construction."

Weyerhaeuser and Rayonier Cooperate

The Weyerhaeuser Timber Company of Longview, Wash., and Rayonier Inc. of San Francisco, Cal., cooperated in the experimental work, the Hercules statement said, supplying wood pulp in the form and according to the specifications required for the smokeless powder work. The pulp and paper companies developed a standard grade of wood pulp in a special size suitable for the experimental work. Through this cooperation, Hercules said, the wood pulp requirements of the United Nations' explosive industries are now such that they can be met easily by wood pulp producers in all of the United Nations.

Cost Lowered About $20,000,000

The company estimated that the Hercules wood pulp development, based upon the difference in the cost of the cotton and wood pulp, will lower the cost of manufacture of smokeless powder at United States ordnance plants about $20,000,000 in 1943.

Shortage of Pyroxylin Material

[FROM OUR REGULAR CORRESPONDENT]

WASHINGTON, D. C., December 21, 1942—A critical shortage exists in raw materials normally used for the production of vinyl resin and pyroxylin coated fabrics, and their use in civilian production must therefore be curtailed because of military requirements, members of the Pyroxylin Vinyl Resin Coated Paper and Fabrics Industry Advisory Committee have been told.

Nitro celluose, film scrap, ethyl cellulose, castor oil and vinyl resins are critical raw materials, Wells Martin, Government Presiding Officer, informed the meeting. The already small supplies are decreasing as military requirements rise.

Emphasis was placed at the meeting on the urgent need for research by the industry to find new and less critical materials to use in place of the present ones.

Because of transportation difficulties, members were urged to recognize the importance of eliminating cross-hauling in the industry as much as possible. Used containers owned by individual companies may still be used by those companies, government representatives stated.

How to Apply the New Wage Act

A manual for employers, personnel directors and labor relations men on how to apply the new Wage Stabilization Act, has just been released by the Labor Relations Institute in New York.

The handbook, "Practical Questions and Answers on Wage Stabilization," is the second in a series of Labor Relations publications resulting from surveys on current employer-employee problems conducted by the Institute's field staff.

The current Report is a compilation of the wage stabilization questions which are proving most troublesome to management executives. Details of the kind of raises which may be given as well as the types of increases which have been disallowed by the new orders are included.

The Institute's special Analysis provides record-keeping forms to help prevent unintentional violations of the complex War Labor Board and Treasury orders.

The Report also lists such pertinent data as the names and addresses of Regional Directors of the War Labor Board and the functions of the recently appointed tripartite panels.

This new publication of the Institute may be obtained without charge by writing to: Lawrence Stessin, director, Industrial Division, Labor Relations Institute, 1775 Broadway, New York City.

A SIGN *of Strength*

Slowly, it seems to anxious eyes, but in reality more swiftly than her enemies ever thought possible, America is gathering her strength to strike. And as she moves forward into the world struggle, the qualities that have made her great become more and more apparent. Her vast natural resources, her disciplined efficiency, her tremendous energy and confidence born of freedom—these are the things that will make her as successful in war as she has been in peace.

To Americans, Niagara has always been a sign of this strength, epitomizing in its great Falls the resources, the energy and the freedom in which we take pride. In its beauty, too, the beauty of the American ideal is symbolized. It is one of the many unique natural wonders that express the active and potential power of a free people whose progress is derived from the exercise of their own abilities in a land of opportunities.

We who work within sight and sound of Niagara Falls are devoting every ounce of our energies and facilities to speeding the flow of chemicals for Victory.

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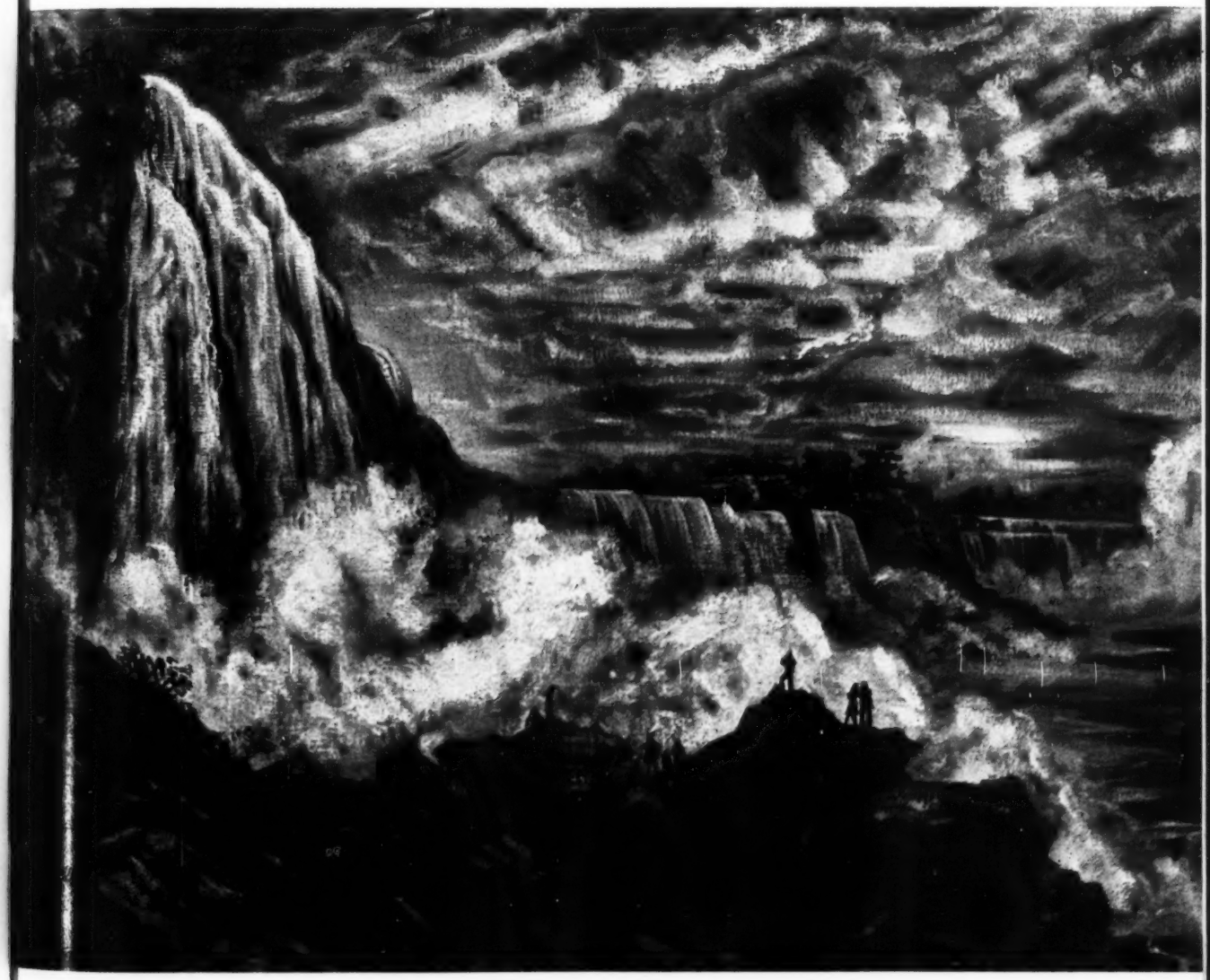

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shaft. This chain is wrapped around its pulley in the opposite direction to that in which the chain supporting the upper clamp is wrapped around its pulley. Motion of the links of this chain causes a change in effective lever arm of the torque applied by this counterpoise and hence changes the scale readings.

During the calibration of the instrument the existence of frictional forces was noted. If the pendulum was displaced from its equilibrium position, either with or without a weight suspended from the upper clamp, and allowed to oscillate, it very quickly came to rest; or if the pendulum was displaced from its equilibrium position and allowed to return slowly until it came to rest, tapping of the instrument caused the pendulum to shift its position. Both of these effects indicated the presence of friction. The effects of friction were even more pronounced if the recording mechanism was coupled to the pendulum.

An estimate of the magnitude of these frictional forces was obtained in the following way: the recording mechanism was connected and while the pendulum was held in a vertical position a weight was hung from the upper clamp. The pendulum was then allowed to move very slowly along the quadrant until it stopped, and the scale reading was noted. The instrument was then tapped to let the pendulum assume a true equilibrium position, and the scale reading was again noted. The difference in these two scale readings was a measure of the friction for this particular condition—i.e., with the recording mechanism attached and with the pawls down. This procedure was repeated with the pawls raised; a similar observation was made when the pendulum was lifted beyond its equilibrium position and slowly allowed to move downward until it stopped, the scale reading was noted, the instrument was tapped, and the true equilibrium reading was noted. The same procedures were followed with the recording mechanism disconnected from the pendulum.

Table I lists the readings obtained by this process.

Under the stated conditions the average force of friction due to the pen carriage was about 0.3 pound. Comparison of the pairs of values obtained with and without the pawls shows that the average frictional force due to the pawls was about 0.5 pound. Comparison of the pairs of values obtained with and

TABLE I.—EFFECTS OF FRICTION

	24.9-lb. Load		14.39-lb. Load		2.22-lb. Load	
	Without Recorder	With Recorder	Without Recorder	With Recorder	Without Recorder	With Recorder
Pawls up and tapping	24.9	24.6	14.6	14.3	2.5	2.2
Pawls up, no tapping	24.2	23.8	14.2	13.8	2.1	1.8
	25.6	26.0	15.0	15.5	2.6	3.2
Pawls down and tapping	24.4	24.0	14.1	14.0	1.9	1.8
Pawls down, no tapping	23.6	23.3	13.7	13.6	1.5	1.2

without tapping of the instrument indicates that the average frictional force due to causes other than the pen carriage and the pawls was about 0.5 pound. This residual friction was found to be due in part to the guide for the upper clamp. This guide is loose but is not accurately placed. The rod which passes through the guide rubs against it. All these frictional forces cause the observed tensile strengths to be less than the true values because the scale reading is less than the actual load on the specimen by an amount equal to the frictional force.

It is difficult to determine a correction for frictional effects which will be satisfactory for all conditions under which the instrument may be used. The values listed in Table I are typical for one condition. The magnitude of the frictional forces was estimated in another fashion. The tensile strengths of three sizes of copper wire were measured on the Scott instrument and on another instrument. This other instrument, "B," was carefully calibrated and was examined for frictional effects; friction was found to be essentially negligible. Copper wire was chosen for testing because of its uniformity. The deviation of individual readings from the mean was much smaller than is commonly the case for paper. The difference between the readings of the two instruments, after correction for calibration error, may fairly be taken as a measure of the friction in the Scott instrument for the conditions of the test. Table II lists the values of the tensile strength found by averaging the readings for 10 specimens. The 0-55 pound scale of the Scott instrument was used. The values are corrected for calibration error.

TABLE II.—TENSILE STRENGTH OF WIRES

Instrument	Wire 22 (lb.)	Wire 20 (lb.)	Wire 18 (lb.)
Scott	17.4	30.4	46.0
"B"	18.7	31.6	47.4

The average difference between the pairs of values is 1.3 pounds. This value compares reasonably well with the average value of 1.1 pounds obtained from Table 1 by subtracting the readings obtained, without the recorder, with the pawls down and tapping of the instrument from the readings with the pawls up and tapping.

The instrument is sturdily constructed; the pendulum arm is short and heavy and shows no tendency to wobble or vibrate in operation. The design is such that the instrument is convenient and rapid to operate. The jaws permit easy and rapid insertion of the specimen, but they would be somewhat more convenient if there were a removable stop on each clamp to permit more rapid alignment of the specimen. The relatively large wheels which operate the jaws permit clamping of specimens with a minimum of effort and are unusually comfortable to use for long routine testing. The jaw anvils tend to rust and require frequent attention to prevent an undesirable degree of rusting.

The expanding pulley unit is a convenient means of changing the operating speed. However, the lowest rate of loading obtainable was 2.5 pounds per second. In view of the current discussion of rates of loading as low as one pound per second it would seem desirable to change the gear ratio to allow use of lower speeds.

The recording mechanism will be more completely discussed in a later report on stretch measurements, but it might be pointed out that the proper alignment of the chart is a somewhat inconvenient process. A stop or a mark along the edge of the chart table would be a convenience in this aligning process. The recording pen meets the paper at such an angle that it tends to stub its point when the carriage is drawn back up to the starting position. A change in the mounting of the pen or in the type of pen would eliminate this trouble. The instrument has no elongation or stretch indicator other than the trace on the chart. Although the recording mechanism is a useful feature of the instrument for many purposes, in the routine testing of paper a separate indicator for stretch would be a convenience if not a necessity.

Literature Cited

(1) The Institute of Paper Chemistry, *Paper Trade J.* 115, no. 5:12 (July 30, 1942).
(2) The Institute of Paper Chemistry, *Paper Trade J.* 106, no. 3:42-44 (Jan. 20, 1938).

The War and the Paper Industry*

By T. Spencer Shore[1]

Although the general public in the United States has been moving toward a more realistic view of the war, there still exists a widespread and deep-rooted belief that the war will be short and can be won with something less than a complete effort. While I believe this sentimental pride in our strength is disappearing, we are still far from a unanimous appreciation of the extreme seriousness of our present position, and an awareness that it is perfectly possible that we can lose this war. To the extent at least that this confidence is based on wishful thinking, it is dangerous, because it detracts from the completeness of our effort.

Every realist to date knows that we are losing this war. It is against that fact that we must measure the accomplishments and the failures of our production program. We cannot get a true concept of progress by measuring the mere bulk of our production, however impressive that may be. We must weigh the quantity and rate of our production of munitions against the amounts of those munitions that we need to stop the enemy, to drive him back, and finally to destroy him.

United Nations Objectives

In the three years since 1938, Hitler has been able to conquer almost all of Europe except the British Isles. Our objective in Europe is to do the same. But our job is a much more difficult one than Hitler undertook, because Hitler conquered and took over Europe from bewildered and ill-prepared peoples; but we must conquer and retake Europe from Hitler.

Our objective in the Pacific area is similarly difficult of attainment. The Japs captured outposts from us that have since been turned by them into strongholds. We must now drive them out of those strongholds and surge onward into the very heart of their powerfully-defended empire.

Thus far, in terms of battles won and battles lost, the United Nations are far from attainment of those and other objectives. We have lost Europe. We have lost vast areas of the Pacific. We have been defeated in the many important campaigns of the Mediterranean. So far we are losing the Battle for Russia—and it is not inconceivable that the Nazis can knock out the Russion armies while we stand by, unable to get to them enough of the things they need. The enemy has waged ceaseless and effective warfare against our ships, and today there is not a sea that our ships may travel without danger of a submarine attack.

In the consideration of these defeats we must not permit the toll taken of the persistently advancing enemy, nor the heroic resistance of the defeated and retreating armies of the United Nations, to blind us to the fact that they were defeats. The best we can say today is that, although we have so far lost the most important battles and campaigns, we are still very much in this war, and we are better equipped and more determined than ever to fight it through to a complete victory and to our kind of peace.

You do not have to go far to find the reasons for our defeats, nor to know why we have not been able to launch powerful, irresistible counteroffensives against the enemy. The reason is that the enemy's war production program has been a complete effort for eight years, while our effort even now is not as complete as it must be.

Mobilization of U.S. Power

At a time when the United States is engaged in a production effort so great that it dwarfs all previous efforts in history, the enemy has occupied and cut us off from many of the sources of materials upon which we have depended for years to supply our ordinary needs. Thus we must maintain an extraordinary effort without many materials that we ordinarily have at our disposal.

The complicated magnitude of our production effort staggers the imagination. The program calls for the total marshaling of an industrial capacity which we have been developing for more than a century. Thousands of peacetime manufacturing plants, augmented by hundreds of special-purpose plants, are intensely engaged in this effort. Civilian production is being cut off except where it is absolutely essential for the maintenance of the war economy. Our factories, our transport lines, our farms, our manpower, will all be mobilized for the single purpose of winning the war.

This great industrial effort is chewing up materials faster than anyone dreamed possible. Getting the raw materials to feed the industrial giant we have harnessed, and planning production so that the materials will get where they are needed when they are needed, is our biggest problem.

Shortages of materials, and, in some cases, labor shortages, prevent us from producing all we want of everything we need. The facilities are available today to do the job, in most instances. There are some plants which could be turning out weapons to smash the Axis which, instead, are silent because there are not enough materials, to keep them going.

We know now that this production job cannot be done without suffering casualties on the industrial front as well as on the military front. There have been casualties already and there will be many more. It is impossible to wrench and jerk a great peacetime economy to a wartime basis without hurting many. Unfortunately, in spite of our tremendous needs, some manufacturers whose facilities are unsuited to war work, and whose normal products are not essential in these grim days of war, are going to suffer.

U. S. Sacrifices

Because of shortages of materials and labor and transportation facilities, it is often impossible to permit these manufacturers to continue to make their normal products. And because their facilities are not of a type needed in war production, they are unable to get war contracts. They are caught in a terrible effort that is bigger and more important than any-

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* Presented at the Fall Meeting of the Technical Association of the Pulp and Paper Industry, Hotel Statler, Boston, Mass., Sept. 29-Oct. 1, 1942.

[1] Director, Division of Industry Advisory Committees, War Production Board, Washington, D. C.

thing else in our national life, and some of them have been and will be casualties on the industrial front.

So far, many of us in civilian life have not begun to sacrifice. Many of our people are, in fact, better off than they have been in years. But I assure you that we shall all know what sacrifices are before this war is over. Our war effort is going to cut deep, and it is not going to miss anyone.

Most of us in civilian life like to think of ourselves as soldiers—soldiers on the home front. It is essential that millions remain on the home front. But let us not delude ourselves. No matter what sacrifices we may be called upon to make, they will be as nothing compared with the ultimate sacrifice which our boys on the fighting fronts must be prepared to make. We are prepared to *sacrifice* and *sweat*. They are prepared to *fight* and *die*. The least we can do is to promise them and promise each other that we will not let them down.

Loss of Fundamental Rights

Until victory is won, no manufacturer should be able to call his plant his own. No worker should be able to call his labor his own. Management and labor alike must dedicate their equipment and their toil to the cause of the American people. They must temporarily give up fundamental rights in order to protect and preserve those rights. Free peoples can afford to give up some of their rights and liberties in a common cause, when they know that they who have freely given may freely retake when their country returns to the normal pursuits of peace.

Pulp and Paper Curtailment

You men in the pulp and paper industry know what I mean when I talk about casualties on the home front. Because of shortages of labor, of materials, of tires, and of trucks, it is necessary to curtail the pulp and paper industry. *The industry is going to get hurt.* To make a maximum contribution to our national effort, the industry must produce what is needed and only what is needed in a wartime economy. This is the time to face the facts realistically. It is no time for the pulp and paper industry, or for any other industry to attempt to stay the tide at the expense of the war effort by seeking to reestablish lost markets for products that are not absolutely essential. It is no time to waste time, no time to waste productive energy, no time to waste materials in the production of nonessentials.

We must face this problem together. Production in the industry must be curtailed to the essential minimum. Let us effect that curtailment efficiently and wisely. Let us schedule that curtailment and accomplish it with a minimum of bitterness and confusion, and with a maximum of good will and common sense.

The war program has now reached the stage at which the imposition of straight percentage cuts on all firms does not provide for the most effective use of the nation's resources. Consequently, the War Production Board has decided that wherever possible a policy of selective limitation shall be applied, with essential civilian production concentrated on certain plants and regions.

There are many stubborn problems which must be solved before concentration can be accomplished in most industries. These problems are particularly difficult in the pulp and paper industry, but they are being studied and attacked; and, with cooperation, many of them can be worked out.

The Industry's Opportunity

You cannot make guns, uniforms, military equipment with the facilities of the pulp and paper industry. But many essential products can be made with those facilities. Increasingly, paper products must be substituted for products made of some scarce materials. I understand that the development of paper-base plastics, for example, is already on the way. I noticed in your exhibits this morning that paper containers and substitutes for tin cans are offering a great opportunity for this industry to help itself by helping to win the war.

In this war economy each of us depends upon the skills and determinations of the others. The workers in your plants depend upon your skills, and you depend upon theirs. You depend upon the War Production Board for skilful leadership, and the War Production Board depends upon you. The man who pilots a bomber depends upon all of us. And all of us depend upon him.

That is why none of us dares to give less than the best he has. As we settle down to this grim business of war, each of us must have confidence that the other fellow is not shirking or worrying about saving his skin. With that kind of unity neither all the Japs nor all the Nazis on earth are going to stop us. When America really gets mad, God help anyone who stands in her way!

Mixing Equipment Co. Expands Line

The Mixing Equipment Company, Rochester, N. Y., announces the addition to their regular line of three new heavy duty air driven mixers. Two of them are gear reduction models. The third is a larger direct drive model.

The important features of these mixers especially adapt them to the mixing of paints, chemicals, high explosives and alcoholic compounds. The air driven motors used in these mixers cannot be overloaded or burned out. Even when used in the heaviest liquids they will not stall. The air exhaust from the motor is so arranged that it keeps the motor running cool at all times.

Models of 1 hp. and ⅓ hp. are available. They are equipped with gear reduction drive and adjustable shaft length.

A New Book on Printing Inks

Printing Inks, their chemistry and technology, by Carleton Ellis, and published by the Reinhold Publishing Corporation, is of value to many paper and paper board manufacturers and to converters who are interested in printing.

The contents include the history of printing inks and vehicles, modifiers and pigments. Various types of inks suited to all printing processes, transfer and emulsion inks and special inks for printing on cellophane, etc., are covered. Practical problems, such as testing inks and paper for printing, are clearly explained.

The book contains 202 pages, with 39 illustrations and micrographs. The price is $4. Copies may be obtained from the PAPER TRADE JOURNAL, 15 West 47th street, New York.

FINANCIAL NEWS

New York Stock Exchange

High, Low and Last for Week Ending December 19, 1942

STOCKS

	High	Low	Last
A. P. W.	1½	1½	1½
Armstrong Cork Co.	32¾	31⅜	31½
Celotex Corp.	8	7⅞	7⅞
Celotex Corp., pf.	74	71¾	74
Certain-Teed Products Corp.	3	2¾	2⅞
Certain-Teed Products Corp., pf.	32¾	31¼	32
Champion Paper & Fibre Co.	18¾	18⅜	18⅜
Champion Paper & Fibre Co., pf.	100	100	100
Congoleum Nairn Co.	17½	16¾	17½
Container Corp. of America	16¾	15½	16
Continental-Diamond Fibre Co.	6⅜	6⅜	6⅜
Crown-Zellerbach Co.	11	10¼	10⅞
Crown-Zellerbach Co., pf.	79¾	78	79
Dixie-Vortex Co.	9¼	8⅞	9¼
Dixie-Vortex Co.—A.	37	36⅞	37
Flintkote Co.	16⅞	15¼	16½
Robert Gair	1⅜	1½	1⅜
Robert Gair, pf.	9⅛	9⅛	9⅛
International Paper Co.	8⅜	7⅞	8¼
International Paper Co., pf.	47	44⅜	46¼
Johns-Manville Corp.	73½	69	72
Johns-Manville Corp., pf.	....	....	....
Kimberly Clark Corp.	26	25	25¾
MacAndrews & Forbes	20	19	19½
MacAndrews & Forbes, pf.	....	....	....
Masonite Corp.	33¼	31	33
Mead Corp.	6¼	5¼	6¼
Mead Corp., pf.	66	66	66
Paraffine Companies, Inc.	37½	36½	37¼
Paraffine Companies, Inc., pf.	101	101	101
Rayonier, Inc.	10	8⅝	10
Rayonier, Inc., pf.	26	25⅞	26
Ruberoid Co.	21	20	20⅝
Scott Paper Co.	38¾	38¼	38¼
Scott Paper Co., pf.	115	115	115
Sutherland Paper Co.	26	25	26
Union Bag & Paper Corp.	7⅜	7¼	7⅜
United Paperboard Co.	3⅛	2⅞	3
U. S. Gypsum Co.	64	60½	61¼
U. S. Gypsum Co., pf.	....	....	....
West Virginia Pulp & Paper Co.	12⅜	11½	11½

BONDS

Abitibi Pulp & Paper Co. 5s '53	48¾	48	48¾
Celotex Corp. 4½s '47	98½	98⅛	98¼
Certain-Teed Products Corp. 5½s '48	95¾	95	95
Champion Paper & Fibre Co. 4¾s '50	....	....	....
International Paper Co. 6s '55	104¾	104⅜	104¾
International Paper Co. 5s '47	103¾	102¾	102¾
Mead Corp. 4½s '55	....	....	....
West Virginia Pulp & Paper Co. 3s '54	....	....	....

New York Curb Exchange

High, Low and Last for Week Ending December 19, 1942

STOCKS

	High	Low	Last
American Box Board Co.	4¾	4½	4½
Brown Co., pf.	....	....	....
Great Northern Paper Co.	26½	24½	26
Hummel-Ross Fibre Corp.	3	2¾	2¾
National Container Corp.	8½	8	8
St. Regis Paper Co.	1⅝	1⅜	1½
St. Regis Paper Co., pf.	118½	118	118¾
Taggart Corp.	3⅜	3⅛	3⅜

BONDS

American Writing Paper Co. 6s '61	91	88	91

Work of the Import Committee

[FROM OUR REGULAR CORRESPONDENT]

Some months ago the Import Committee of the American Paper Industry reported that Customs officials believed that all customs court cases involving protests by alien enemies against the duties levied on imported goods were automatically void, on the ground that such aliens have no standing in United States Courts. A decision by the United States Supreme Court, however, overrules this contention, giving enemy aliens living here the right to bring lawsuits in our courts. While the test case involved a personal injury damage claim, the principle extends to customs cases. Many cases involving such importations have been suspended, on application of the protestants, until after the war is ended. Meanwhile the importers have been required to pay the duties assessed by Customs officials, and their recourse, after the war, will be to secure, if possible, refunds of sums already paid, on the ground that the actions of the Customs officials were not in accord with the tariff law.

Three cases involving the dutiability of midsoling imported from Canada in 1939 have been decided in favor of the importer. The Customs officials computed duty on the basis of the selling price of the board in Canada plus the 8 percent sales tax. It was shown, however, that the 8 percent tax was not collected in Canada on this merchandise which was only sold by the manufacturers to shoe manufacturers, and the sales tax was applied to the shoes only.

Deep pink cull rolls of newsprint paper for an American jobbing house, imported from Canada, classified for duty as printing paper, were held to be duty free as standard newsprint, by stipulation between the Customs officials and the importers. The decision was probably due to the court's action in a test case involving a paper which had been held by Customs officials to be dutiable as poster paper, but decided by the Court to be the color chiefly used by newspapers and therefore duty free.

Imported material claimed by the importer to be bleached sulphite pulp, and therefore duty free, but thought by Customs officials to be possibly paperboard, was classified as claimed by the importer after the Import Committee had secured opinions from domestic pulp producers indicating that the material was actually pulp as claimed.

Another series of cases involving the Cuban Reciprocal Treaty has been abandoned by importers who have given up their claims that the 20 percent Cuban preferential is also applicable under Most Favored Nation Treaties to products of other countries. Twenty such cases were abandoned in November, including shipments of bristol, tracing, marble, straw wrapping, carbonizing tissue, and kraft wrapping papers, and pulp board.

Standard Paper To Pay Dividend

Standard Paper Manufacturing Company of Richmond, has declared a quarterly dividend of 1½% on its $50 per value preferred stock, Secretary-Treasurer W. Byron Taylor has announced. The action was taken by the board of directors at a meeting December 10, and the dividend is payable December 28 to stockholders of record December 15. The directors also voted a dividend of 50 cents a share on its $50 par common, payable on the same basis.

MacAndrews & Forbes Votes Dividend

The MacAndrews & Forbes Company has voted 60 cents, payable January 15 to stockholders of record December 31. Payments in 1942 were 75 cents January 15, 40 cents April 15, 35 cents July 15 and 30 cents October 15.

New Literature

Tool attachments for maintaining high production, are discussed in a bulletin issued by the Invincible Tool Company, 611 Empire Building, Pittsburgh, Pa. It describes the Invincible line of tool attachments for all types of machine repairs, for difficult angle work and where lack of space makes the use of regular tools impractical.

Equipment for heavy industries is described in Booklet No. 236, issued by the Whiting Corporation, Harvey, Ill. It gives concise facts on the company's varied products, including cranes, foundry equipment, filters and other special equipment for heavy industries.

Switchgear of modern types is the subject of Bulletin B-6185, issued by the Allis Chalmers Manufacturing Company, Milwaukee, Wis. It describes indoor and outdoor types, facts on switchboards of all types for controlling feeders, bus ties, generators, transformers, etc. The latest developments include the air blast circuit breaker and switchgear as a part of the new factory-assembled unit substations.

Humidification data is the subject of a bulletin issued by the Armstrong Machine Works, Three Rivers, Mich. It describes the application of Armstrong humidifiers in paper storage and paper cutting rooms, for maintaining glue strength in paper box plants, and providing correct relative humidity tests in paper testing laboratories.

Frequency recorders and indicators are discussed in Catalogue N-57-161 issued by the Leeds & Northrup Co., 4934 Stenton avenue, Philadelphia, Pa. It describes in detail the company's Micromax instruments. These instruments regulate automatically or by hand, and provide permanent records of trends to operators and which can be filed for reference.

Carload stowage is the subject of a bulletin issued by the Gerrard Co. 4701 South Richmond street, Chicago, Ill. It describes the application of Gerrard round steel strapping, in car loading of paper rolls, crated goods and many miscellaneous items.

Cans Placed Under Paper Board

[FROM OUR REGULAR CORRESPONDENT]

WASHINGTON, D. C., December 23, 1942—Fiber tubes and cans have been placed under the paper board products regulation by OPA in order to remove inequities existing between certain producers of those products.

The action was taken in Amendment No. 2 to Maximum Price Regulation No. 187 effective December 23. Before the amendment was issued prices for these products had been governed by the General Maximum Price Regulation.

In February, 1942, a substantial portion of the manufacturers of fiber tubes and cans and similar products, at the request of OPA, signed an agreement not to increase prices above those charged in October, 1941. Later, when the General Regulation went into effect in April, the ceiling prices of this group were established at that level. But for some of the manufacturers who had not signed the agreement, ceilings were fixed at higher levels since they had been selling at higher prices during March, 1942, base period under the General Regulation.

This action places maximum prices of all the manufacturers at levels prevailing during October 1941, thus removing the inequities.

Season's Greetings:

Christmas this year seems to touch all of us more deeply than usual. We send Good Wishes and Good Cheer to the thousands of our Soldiers and Sailors who have gone into War Service from paper and board mills throughout the Nation.

- - - To You All, the Makers of TENAX FELTS extend these Greetings:

A Merry Christmas and a Happy and Prosperous New Year

LOCKPORT FELT COMPANY
NEWFANE, N. Y.—U. S. A.

CONSTRUCTION NEWS

Under limitations order L-41 all projects involving expenditures of more than $5,000 must be specifically approved by the War Productions Board. The status of projects reported herewith under the provisions of the order is not known.—EDITOR.

Newton, Mass.—The Sherman Paper Products Corporation, Oak street, Newton Upper Falls, manufacturer of paper goods, has approved plans for addition to boiler house at mill, to provide for coal storage and other facilities. No estimate of cost announced. General erection contract has been awarded to Peter F. Rossi & Co., 820 Massachusetts avenue, Arlington, Mass., and work will be carried out at once. Alonzo B. Reed, 88 Broad street, Boston, Mass., is architect.

Rhinelander, Wis. — The Rhinelander Paper Company, manufacturer of glassine, greaseproof and other processed paper stocks, has begun construction of new addition to be used for storage and distribution. Erection will be carried out by day labor, with exception of roofing which will be handled by E. D. Chase Company, Oshkosh, Wis. No estimate of cost announced. W. M. Hayes is chief engineer, in charge.

Los Angeles, Calif.—The Zellerbach Paper Company, 3000 East 12th street, manufacturer of paper products, has leased certain local property to the Government, and will vacate at once for another location. It will be used by the Army Air Forces.

Cleveland, Ohio—The Great Lakes Box Company, 7275 Wentworth avenue, manufacturer of folding paper cartons and other paper containers, is considering early rebuilding of four-story plant, including one-story adjoining structure used for storage and distribution, recently destroyed by fire. Loss reported close to $100,000, including equipment.

Memphis, Tenn.—The Sefton Fibre Can Company, 3275 Big Bend road, St. Louis, Mo., manufacturer of fiber cans and containers, has modernization and expansion under way at new branch plant at 208 West Georgia street, Memphis, recently referred to in these columns. Work will include construction of a new one-story addition, complete remodeling of existing structures, and installation of equipment for large output. Completion is scheduled at early date. Cost reported in excess of $100,000, including machinery.

Belleville, N. J.—The Newton Carton Company, 68 Oliver street, Newark, N. J., manufacturer of folding paper cartons and other paper containers, has concluded negotiations for purchase of a two-story industrial building at 740 Washington street, Belleville, on site about 124 x 325 feet. Structure was built and used by the Kelsey Motor Car Company a number of years ago, now defunct. It is now occupied by Air Associates, Inc., a subsidiary of Bendix Corporation, New York, N. Y., with lease expiring May 1, 1943. Purchasing company plans to occupy after that date, removing present plant to new location and providing additional equipment for increased capacity.

Philadelphia, Pa.—The Brown & Bailey Company, 417 North Eighth street, manufacturer of folding paper cartons and other paper containers, is running on a capacity schedule, giving employment to about 125 persons in different production divisions. It is expected to hold to present operating basis for an indefinite period.

Baltimore, Md. — The Baltimore Paper Box Company, 1300 Covington street, manufacturer of corrugated boxes and containers, has awarded general contract to Consolidated Engineering Company, 20 East Franklin street, Baltimore, for rebuilding and improving structure on Key Highway, used for storage and distribution, recently damaged by fire, previously noted in these columns. Work will be placed under way at once. No estimate of cost announced. Crout, Snyder & Crandall, 20 East Lexington street, Baltimore, are architects.

Metuchen, N. J.—The Celotex Company, manufacturer of wall board, insulating board and kindred board products, is operating on a capacity schedule at its branch mill on Middlesex avenue, Metuchen, giving employment to more than 100 persons in different departments. Present production basis is expected to be continued for an indefinite period.

Michigan Carton Gets Bull's Eye Flag

BATTLE CREEK, Mich., December 21, 1942—Presentation of a banner and top treasury award of the "Bull's-Eye" flag was made at the Michigan Carton Company December 15 with a background described by Administrator Wade as the most colorful he had witnessed in the state. Members of the high school band furnished a musical program and more than 300 persons were present in the space that had been cleared in the carton division of the plant. J. E. Orvis, personnel director of the company, acted as master of ceremonies and introduced Mr. Kies, Mr. Genebach and Robert B. Miller. Administrator Wade was introduced by Mr. Conklin, county chairman of the bond drive.

Mr. Wade expressed his hearty commendation of the achievement of Carton company workers and presented certificates to C. F. Robinson, on behalf of Local No. 445, electrical workers; John Rook, Local No. 46, machinists; Mearl M. Luhrs, Local No. 356, operating engineers; G. H. Porter, Local No. 20910, AFL, and to Lawrence G. Fell, company president. Mr. Fell briefly outlined the progress of the campaign that had attained the 100 percent goal, describing how the start had been slow but that through cooperation of workers in all departments the drive had closed with a whirlwind finish.

The "Bull's-Eye" flag was received on behalf of the company from Mr. Wade by Miss LaDuska Higdon and Clair Almond. Because of the two major divisions at the company, a banner was awarded to be displayed in the paper mill division, while the flag will fly from the staff over the carton division.

NEWSPRINT PRICE DISCUSSED

(Continued from page 7)

relatively insignificant. In this industry too the volume of production is limited by the inadequate supply of raw materials. During the past season less than 10 million cubic metres of pulpwood were cut, whereas the requirements of the pulp mills are estimated at 15 million cubic metres. The stocks of raw materials in the mills are at present insufficient and will doubtless be further depleted. There is a considerable demand for viscose pulp in particular. A certain amount of pulp is still being exported to South America, though that market has been further curtailed by the entry of Brazil into the war. For the first time since the spring of 1940, a consignment of wood goods has also been exported to South America, viz., the Argentine. The sales of woods goods on European markets have been smaller than last year."

The dispatch further states that lubricating oil distilled out of the tar extracted from old pine stumps has been tested by the State Material Testing Institute with surprisingly good results, the oil surpassing expectations in regard to quality. Pine tar, it is added, is now regularly used as fuel by the large fishing boats on Sweden's west coast.

Many experiments are under way for the production of new synthetic materials from wood. A substance allied to synthetic rubber, a polysulphide, has been produced on a trial scale by one pulp concern, and will probably be available on a commercial scale in the beginning of next year under the name Modotiol A. It stands for a strongly sulphurous, plastic but also slightly resilient substance which in some cases can replace rubber. A young scientist at the Swedish Wenner-Gren Institute has recently produced a kind of thiocol, based on lignosulphonic acids in sulphite lye. The main technical data for the erection of factories for the production of fodder yeast from sulphite lyes have been prepared, and production will be started at the Svartvik sulphite mills this winter.

Steps Toward Free Trade

Warren B. Bullock, manager of the Import Committee of the American Paper Industry, has called to the attention of the industry two important steps taken by the administration in pursuance of its persistent plan to "reduce tariff barriers." One is legislation pending in Congress to give the President power, among other grants of authority, to suspend any or all tariff provisions which in his judgment should be suspended to promote the war effort. The proposal is now in the Ways and Means Committee of the House of Representatives, where an effort is being made to rush through legislation before the end of the month when a new Congress, presumably less pro-administration, will come into being. The bill provides authority to suspend immigration and other laws, and even the administration leaders objected to some phases of the original proposal. The Ways and Means Committee, however, has no such qualms against granting wide powers for suspension of tariff laws. The second step toward free trade is an agreement signed between the United States and Canada. It contains the significant hint that this convention may be extended to all other Western Hemisphere Nations.

UNITED PIGMENTS

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Suitable for ALL types of paper ranging from thin printing papers and waxing tissues to coated book and magazine stocks.

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NEWARK, NEW JERSEY

SALES OFFICES IN PRINCIPAL CITIES

PAPER TRADE JOURNAL

Title Reg. U. S. Pat. Off.

Henry J. Berger

EDITOR

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COMING EVENTS IN PAPER INDUSTRY

American Paper and Pulp Association, Sixty-sixth Annual Convention and meeting, Waldorf-Astoria Hotel, New York, February 15-19.

Technical Association of the Pulp and Paper Industry, Convention, Commodore Hotel, New York, February 15-18.

National Paper Trade Association of the United States, Convention, Waldorf-Astoria Hotel, New York, February 15-18.

The New York Association Of Dealers In Paper Mills' Supplies, Annual Banquet, Commodore Hotel, New York, Tuesday, February 16.

New England Section. Technical Association of the Pulp and Paper Industry—Third Friday of each month at the Roger Smith Hotel, Holyoke, Mass.

Delaware Valley Section. Technical Association of the Pulp and Paper Industry—First Friday of each month at the Engineers Club, Philadelphia, Pa.

Lake States Section. Technical Association of the Pulp and Paper Industry—Second Tuesday of each month at the Conway Hotel, Appleton, Wis.

Kalamazoo Valley Section. Technical Association of the Pulp and Paper Industry—First Thursday of each month at the Park, American Hotel, Kalamazoo, Mich.

HIGH TAXES AND DEBT

As war expenditures mount, industrial expansion is increasing at a gratifying rate. In November, the total amount rose 5% to close to $6 billion. Although expenditures are scheduled to be substantially higher next year, production of military goods now aggregates more than 50% of the total industrial production, and is expected to rise still higher in 1943. The first year of war has cost more than $46 billion, which is more than the total U. S. cost of World War I. The public debt is now above $100 billion. With so considerable a part of our labor and material resources utilized in the war effort, high taxes and a large standing national debt is forecasted for the post-war period.

In commenting on this subject, Henry H. Heimann, executive manager-on-leave of the National Association of Credit Men, said in the association's year-end review, issued on December 15, that, "While the tax pattern cannot be predicted in detail, it appears logical to expect requests for further increases in individual and corporate income tax rates. Enactment of a withholding tax on a 'pay as you go' basis in 1943 is virtually assured, and there is a strong possibility that the new year will witness the introduction of some kind of forced savings program. These 'rebatable taxes' will have the same influence on spending power as do regular taxes. Being repayable after the war, they will have greater public acceptance than higher taxes. And their repayability will be another contribution to post-war purchasing power. Our taxes after the war will undoubtedly continue to be high. For long-range planning considerations, however, it is well that we keep in mind the likelihood that we are apt to operate for generations to come, as did England after the Napoleonic Wars, with a large standing national debt. Our financial policies will be designed largely to service that debt rather than to reduce it materially within a reasonably short period."

In reference to another aspect of the national and international situation, Mr. Heimann forecasts continuation of the upward trend in farm prices and farm income; a decline in civilian business volume; a substantial drop in private construction; further decreases in the volume of outstanding consumer debt; a levelling-off process in the labor field, and continuance of governmental control of export and import trade. Discussing war finance and inflationary possibilities, Mr. Heimann points out that "the recent announcement that the bill for the second year of war will total $100 billion was almost simultaneous with the news that our national debt had passed that mark. "Since we are scheduled," he states, "to collect some $25 billion through taxation next year, it is apparent that about $75 billion will have to be borrowed during 1943 by the federal government. Taxes obviously will not be able to raise the major portion of those vast sums currently. The alternative, a continuing and rapid rise in the national debt is evident."

Relative to war finance and inflation, Mr. Heimann said in part: "The manner in which our war financing is conducted, however, will have an important influence on the inflationary situation. Beyond the heaviest possible taxes, we will have to rely upon individuals and non-bank investors for as much of the borrowing as possible, since bank borrowings are inflationary in character. The banks will, of course, carry a considerable share, for the cost of the war program cannot conceivably be met entirely out of taxes and borrowings from non-bank sources. During the first year of war, for example, the federal government raised approximately $65 billion. Of this amount some $15 billion were in taxes and $50 billion were borrowed, with approximately $20 billion of the borrowed dollars being supplied by the banks, which are now estimated to hold nearly half of the government's direct and guaranteed obligations. Currently the Treasury is engaged in a new Victory Loan Drive to raise at least $9 billion. Hopes of reaching a $12 billion total have been indicated. The magnitude of this fiscal operation is revealed when we recall that the fourth Liberty Loan Drive of World War I, the largest single government financing operation on record, raised approximately $7 billion through the enlistment of 23 million investors."

In analyzing the outlook for small business, Mr. Heimann states that, "It must be the wish of every-

one interested in the maintenance of the private enterprise system that small business be given sound encouragement in its effort to come through the war period. The small businesses that survive the present emergency will be solidly entrenched. Their relative freedom from complexity will enable them to move with dispatch in the reconversion period. The war-stimulated developments in the fields of synthetic and substitute materials will provide new opportunities. . . . "The trend toward salary limitation, evidenced in the recent establishment of the $25,000 net limit, may well cause executives formerly available to big business to embark in undertakings on their own account where the legal limitation on earnings will be offset by the intangible dividends of more direct control and a greater sense of tangible contributions to the national and world economy."

In commenting on corporate earnings, Mr. Heimann states that, "Corporate income reports to date reveal a general tendency toward lower net income because of high tax claims. Paralleling this trend is the decline in cash dividend payments. A continuation of this general trend for the duration of the war is predicted."

Abe Cooper Buys Industrial Properties

WATERTOWN, N. Y., December 21, 1942 — Announcement is made that Abe Cooper, president of the Bagley & Sewall Company, has virtually completed negotiations for the purchase of the plant of the Shaughnessy Knitting Company and the buildings of the Oswego Board Company, at Oswego. Recently he also purchased the mill, equipment and water power of the defunct Robert E. Read, Inc., at Dexter. The latter concern manufactured moulded pulp products until it suspended operations. About four years ago he purchased the plant of the Bagley & Sewall Company, which is now in operation. Later he purchased the abandoned mill of the Hinde & Dauche Paper Company, giving him control of every industrial plant in the Sewall Island section except some power holdings. The purchase of the Shaughnessy plant and the property of the Oswego Board Company is being negotiated from the estate of the late Floyd L. Carlisle, of Locust Valley, L. I. This purchase was speeded up through the desire of the Carlisle estate to liquidate properties owned by him in various parts of the country. The transaction does not include the machinery and equipment of the Shaughnessy concern which will continue in operation with the present officials. It is expected that arrangements will be made whereby the concern will continue to occupy the building and carry on the manufacture of knitted products.

Mr. Cooper is now making arrangements for leasing the former plant of the Robert E. Read, Inc., at Dexter. The Read mill was formerly the Warren Parchment Company. Mr. Read purchased it several years ago and expended considerable in having a special machine manufactured on his designs for the production of various kinds of shipping containers from moulded pulp. The business of the concern, however, proved unprofitable and the plant closed a few months ago.

Production Ratio Report*

(Production as per cent of six-day capacity)

COMPARATIVE WEEKLY SUMMARIES

Current Weeks—1942		Corresponding Weeks—1941	
November 7	88.4	November 8	105.0
November 14	89.6	November 15	107.0
November 21	87.5	November 22	105.3
November 28	83.5	November 29	107.7
December 5	84.9	December 6	106.9
December 12....(Prelim.)	*86.7*	December 13	106.3

COMPARATIVE MONTHLY SUMMARIES

Year	Jan.	Feb.	Mar.	Apr.	May	June	July
1941	85.6	89.7	92.2	96.0	98.7	99.3	94.2
1942	104.5	103.9	102.9	100.4	95.3	87.4	75.8

Year	Aug.	Sept.	Oct.	Nov.	Dec.	Year Avg.
1941	101.0	99.7	105.2	106.2	100.4	97.4
1942	80.8	82.9	90.7	*87.1*	....	....

COMPARATIVE YEARLY SUMMARIES

	1935	1936	1937	1938	1939	1940	1941	1942
Year to Date..	69.9	80.3	81.6	71.5	83.1	86.0	97.4	*91.4*
Year Average.	69.9	80.4	79.8	71.5	83.4	85.6	97.4	...

* Based on tonnage reported to American Paper and Pulp Association. Does not include mills reporting to National Paperboard Association, except in isolated cases where both paper and paperboard are produced and separate tonnage figures are not readily available. Does not include mills producing newsprint exclusively.

PAPERBOARD OPERATING RATIOS †

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year Avg.
1937	83	89	89	91	88	80	69	77	72	70	57	47	75
1938	56	63	63	60	60	59	59	60	70	73	67	61	64
1939	65	73	76	74	69	73	68	77	82	91	88	77	77
1940	78	75	74	76	82	85	77	79	78	85	82	77	78
1941	81	88	89	89	91	94	92	98	95	99	98	90	92
1942	102	101	101	95	82	72	68	75	76	81	*82*	..	..

Week ending Nov. 7, 1942—84
Week ending Nov. 14, 1942—83
Week ending Nov. 21, 1942—83
Week ending Nov. 28, 1942—77
Week ending Dec. 5, 1942—82
Week ending Dec. 12, 1942—*84*

† Per cents of operation based on "Inch-Hours" reported to the National Paperboard Assn.

To Conserve Paper Board Containers

[FROM OUR REGULAR CORRESPONDENT]

WASHINGTON, D. C., December 23, 1942—The problem of conservation of paper board containers, particularly those made from virgin pulp, was considered at three recent meetings of the industry advisory committee with the Drugs and Cosmetics Section of the Chemicals Division in Washington.

Representatives of the Containers Division discussed the impending shortage of virgin pulp at meetings with the Proprietary Drug Manufacturers Industry Advisory Committee, the Toiletries and Cosmetics Industry Advisory Committee, and the Pharmaceutical Manufacturers Industry Committee.

Production of virgin pulp used in some types of paper board for containers is becoming critically short because of a decrease in logging operations caused by a shortage of manpower. Since the supply of virgin pulp is declining while demand for paper to replace metal in drums and containers is increasing, curtailment of less essential uses is becoming necessary.

Subcommittees were appointed at each meeting to study the problem and make recommendations to the section, showing where curtailments and limitations can be made. These recommendations will be considered in the study that is being made of the problem by the Containers Section. The industries concerned were asked to assist the committee on its work.

The government presiding officers announced at each committee meeting that plans are being made for the formation of a transportation advisory committee to consider all transportation problems with which the drugs and cosmetics industries are concerned.

TIMELY ECONOMY

IN THE USE OF WAX SIZE

RISING COSTS OF ROSIN. The increased cost of rosin is a source of considerable concern to the paper manufacturer. Meanwhile, the price of paraffin wax has become stabilized at a satisfactory level. Together, these two factors now serve to reduce the cost differential in these two paper making commodities. As a result, it is now possible to effect an actual production cost saving in the sizing of most paper and paper board by substituting dispersed paraffin wax for part of the rosin size normally used.

QUALITY RESULTS. Of course, above everything, the quality of the paper must be maintained. In applying this principle the paper maker may expect standard water resistance, and tensile and bursting strength. Tearing strength and pliability will increase to a certain degree. With the same degree of calendering, smoothness will be higher but may be controlled as desired in the usual ways.

MEETING NEEDS OF THE TIMES. In these times when raw materials are at a premium, it behooves us to make the most efficient use of the things we consume, both for the sake of the materials themselves and for the sake of conserving our financial resources that we contribute to the maximum extent to the Victory effort.

Cyanamid technical service men and sales representatives have built up a fund of experience in the application of wax sizes, over a period of years, and will be glad to discuss this matter with you and frankly advise you of the possibilities of effecting savings by the use of wax sizes. This is one of the many services Cyanamid has developed in its efforts to maintain steady progress in the improvement of staple chemicals and to make available new tools for the paper maker to use. Just write or tell your Cyanamid representative about your problem. There is no obligation.

"Use a Cyanamid wax emulsion with rosin. Wax prices are stable. Replace part of rosin with wax and effect a real saving while improving paper quality."
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ROSIN SIZES • SYNTHETIC RESINS
CASEIN • ALUM • CORN STARCH
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OTHER PAPER CHEMICALS

*Reg. U. S. Pat. Off.

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Section of the
TECHNICAL ASSOCIATION
OF THE PULP & PAPER INDUSTRY
Edited by R. G. Macdonald, Secretary

Composition Bearing Applications in Industry*

By John A. Petho[1] and Frank W. Vogt[2]

Abstract

As the use of water-lubricated bearings has been so generally extended in industry an explanation of the fundamental characteristics of the material itself and its operating requirements will be of interest to engineers in many fields.

Tests on different types of fabrics in general use show some are particularly suited for heavy-duty operation.

The design of the bearing, the accuracy with which it is installed, the temperature and kind of cooling water, and the finish of the journal have been proved under laboratory and field conditions to directly effect the operation of these synthetic bearings. A better understanding of the details of these factors will no doubt encourage more wide-spread use of this comparatively new bearing material and prevent its misapplication or improper use.

Results of laboratory tests on their lubrications with grease are given to explain how their range of application can be extended to low-speed service.

Illustrations of actual installations show some simple and effective water arrangements and general bearing design that have been developed as the result of several years of operating experience.

All of these considerations are particularly timely because of the present restrictions on strategic bearing metals such as bronze and babbitt. Synthetic bearing materials are satisfactorily filling this pressing need.

Composition bearings of the phenol-formaldehyde condensation type were introduced to the field about ten years ago to replace metallic bearings. The art of manufacturing these bearings was broadened with the passing of each year and their use has been gradually extended from their first installations on light loads at relatively high speeds to heavy loads and moderate speeds. Finally their quality was improved to the point where they are adaptable for almost all speed and load conditions in the present day bearing applications, and synthetic bearings have now become definitely established in paper and steel mills in a wide variety of positions.

It is true that due to its entirely different characteristics from any of the metallic type of bearings, its successful use is partly dependent on the operating men becoming familiar with a few simple requirements. This discussion conveys experiences as suppliers of synthetic type[3] of bearings and other information to promote a better understanding of composition bearing material.

Characteristics

Composition bearings are made with a filler such as paper, fabric, asbestos, or glass and held together by a binder of synthetic resin. Depending on the type of filler and binder, and the time, temperature, and molding pressure of the cure, materials with different characteristics will be produced. Table I shows the changes possible with the increase of molding pressure alone.

TABLE I (1)

Molding pressure p.s.i.	2300	4600	9200
Modulus in tension p.s.i.....	0.72×10^6	0.85×10^6	1.03×10^6
Modulus in bending p.s.i.....	0.78x10	0.91x10	1.14x10

For general bearing use only the fabric base materials are considered with a synthetic resin binder. There are a number of possible combinations with this base and they can be divided into groups as follows:

A. Lightweight laminated fabric (4 to 17 oz.)
B. Heavyweight laminated fabric (single to 4 ply belting)
C. Groups A and B made with pure synthetic resin
D. Groups A and B made with a synthetic resin containing a so-called solid lubricant such as sericite, aluminum oxide, talc, graphite, etc.
E. Either of the combinations used with macerate instead of laminated fabric base.

The fabric treated with a synthetic resin (used as a binder) is molded at pressures from 2000-3000 p.s.i. and temperatures of 300-350° F. The length of molding time is controlled by the desired thickness of the final product. Some of the physical characteristics of laminated-fabric base bearings are shown in Table II.

TABLE II.—PROPERTIES

Tensile strength (depending on fabric).....	8,000—11,000 p.s.i.
Flexural strength (depending on fabric).....	18,000—22,000 p.s.i.
Compressive strength, flatwise	40,000—45,000 p.s.i.
Compressive strength, edgewise.....	20,000—25,000 p.s.i.
Molulus of elasticity	1,500,000 p.s.i.
Brinell hardness	30—40
Water absorption 24 hours.....	0.5—1.0%

Conductivity

This synthetic type of bearing is lower in thermal conductivity than any of the bearing metals. Just a few years ago the coefficient of thermal conductivity of synthetic bearings was approximately one hun-

* Presented at the Fall Meeting of the Technical Association of the Pulp and Paper Industry, Hotel Statler, Boston, Mass., Sept. 29-Oct. 1, 1942.
[1] Continental Diamond Fibre Co., Bridgeport, Pa.
[2] Joseph T. Ryerson & Son, Inc., Jersey City, N. J.
[3] Ryertex.

dred times smaller than that of a tin-base alloy bearing; however, the addition of heat conducting fillers to the resin cut this difference by more than half and indications are that this can be further increased without noticeably reducing the other desirable charactertistics of the material.

Operating Characteristics

All bearings whether they are metallic or composition are limited in performance by the maximum allowable temperature of the material. All plain bearings generate frictional heat and its control will spell success or failure in any bearing applications. Friction is the result of surface contact and it is sensitive to the relative smoothness and hardness of the surfaces involved. The roll neck or journal should be smooth and free from scratches and pits. When heavy bearing loads are involved the finishing of the necks must be done very carefully, because it is one of the important factors in synthetic bearing operation. Good chuck fit is second in importance to smooth bearing surface. The chucks and the bearings should be machined to a good fit. When chucks and bearing liners are not in perfect agreement as to their contours, hot spots will develop due to the concentration of the load, and if not controlled failure is likely. If it is assumed that all bearing liners have a perfect backing in a chuck strong enough to resist bending strains, then the contact area is the next consideration.

Regardless of make-up, this type of bearing has a fine resin film on the surface which is hard and slightly abrasive in action. This increases the operating temperature in the running-in period and calls for extra care for the first few hours of operation. We can go further and take a bearing with a perfect chuck fit, roll neck in excellent condition, skin removed from the bearing surface and still have it operate hot. This behavior can be created by too large an arc of contact for the bearing. An arc of contact over 120° is not desirable for synthetic bearings due to the resiliency of the material which under heavy loads will spring in and produce a chocking effect on the roll neck or journal. Where bearing loads are light this behavior need not be considered. In some designs attempts are being made to eliminate this clamping by using a bearing with an inside diameter up to 1/16 inch larger than the outside diameter of the roll neck. Occasionally this is worse than the clamping itself, because if the load is not sufficient to compress and cold-flow the material to the form of the roll neck, a heavy load concentration will take place resulting in hot spots and eventual wiping of the bearing. Arc of contacts just large enough to maintain proper roll alignments should be used with synthetic resin bearings, and may be much less than with metal bearings. However, under light loading danger from hot spots is not serious. The proper contact area is gradually established in operation at a point where wear is eliminated.

Lubrication

So far we have considered the reduction of frictional heat by the means of providing perfect surfaces and bearing fits. However, due to the low heat conductivity of composition bearings their operating temperature must be regulated with proper application of a cooling medium. Knowing the critical temperature and the rate of heat generation the problem is reduced to determining the rate of cooling which will permit operation below this temperature. Cooling of roll necks or journals is generally accomplished by heat conduction through the medium of water. The amount of water necessary for cooling is dependent on several factors.

(*a*) The heat generated in the bearing itself. The rate of heat generation at any instance is $fPV/78$ B.t.u. per square inch of bearing area per minute, where:

f = coefficient of friction
P = hearing pressure, p.s.i.
V = rubbing velocity in f.p.m.

(*b*) The type of work, whether continuous or intermittent with light or no load periods.

(*c*) The amount of heat transmitted from the roll body.

(*d*) The temperature of the cooling water, its location, and the exposed roll-neck area.

An easy flow of water with ample volume rather than a jet-type pressure spray usually is more effective. The water should be directed to cover as much as possible of the exposed journal surface. When bearings cover the top and bottom of the journal the water should be applied to both sides between the top and bottom bearings.

Water, however, must be further specified: first, its temperature is a factor in the rate of heat transfer; second, it must be free from abrasive impurities such as dirt, sand, etc.; and third, it must be free from chemical impurities such as salt. When there is a trace of salt or acid in the cooling water, a surface breakdown of the roll neck is sure to follow resulting in abnormal wear on the bearing. On the other hand, water in closed systems can be treated to result in increased bearing life. It is not the intention of this discussion to enter into the theories and facts behind the last statement. However, it is noticed daily that under certain load, speed, temperature, and water conditions a dark film is deposited on the surface of the journal or neck and as soon as this film is in evidence a reduction in power consumption and a drop in operating temperature is noticed. The creation of this film is partly chemical and partly mechanical and the important fact is that the separation of the bearing surfaces by this film results in a higher efficiency in operation.

This phenomenon prompted the investigation of lubricants as the means of producing a separating film between the rubbing surfaces. Water-soluble oils at the beginning showed their inability to maintain a separating film even under moderate load conditions. The same characteristics were noticed on most of the water-repellent oils investigated. The reason for this was the inability of the oil to adhere to the rubbing surfaces. Some of the high-pressure greases operated satisfactorily at speeds of 200-250 f.p.m. and medium loads up to 1750 p.s.i. but failed badly at low speed on high bearing pressure applications. The final investigation was made with *extreme pressure* quality greases, and here compounds containing tallow or suet proved themselves to be superior to most of the other types of extreme pressure mediums. Graphited forms of greases in all instances were detrimental to the synthetic bearing surfaces. Tests on lubricants proved the importance of water cooling to maintain a reasonable operating temperature, as it was noticed that, with the exception of the self-generated dark film referred to above, all other grease films operated at a higher coefficient of friction, and this friction was dependent on the lubricant used and independent of

the type of synthetic bearings. Table III shows the coefficient of friction of the most common grades of synthetic bearings in comparison with metallic bearings at 80 f.p.m., 3000 p.s.i. bearing pressure, continuous loading and water cooling only on the synthetic bearings. The coefficient of friction figures show a considerable increase in friction with the decrease of the fabric weight especially for this low-speed, high-pressure application.

TABLE III

Type of bearing	Lubrication	Coefficient of friction
15-oz. laminated fabric	water only	.054
Single-ply belting	water only	.023
4-ply belting	water only	.007
Babbitt	grease and water	.017
Tin alloy	grease and water	.013
Bronze	grease and water	.01

It should be pointed out that in considering the above figures on friction that, when metallic bearings are operated in wet places with grease or oil for lubrication, it is not at all uncommon to find adverse conditions. The position of the bearing may be such that the grease cannot be kept in contact wtih the journal or that it is being washed off by the cooling water with the result that actually the bearing is being operated with water only as a lubricant. When this condition exists the coefficient of friction on metallic bearings is increased many times and frequently exceeds 0.110. Badly scored journals usually indicate the existence of this unsatisfactory condition.

By contrast, when a composition bearing replaces bronze or babbitt in such a location and the only lubrication requirement is a stream of water on the journal, immediate improvement of operating conditions follows. This is one of the main reasons why this type of bearing has been so widely extended in paper and steel mills today.

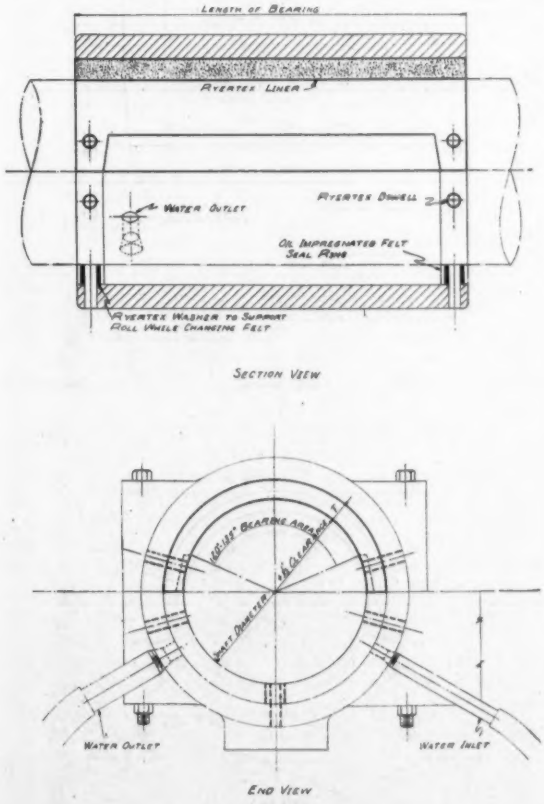


FIG. 1
Ryertex Top Press Roll Bearing

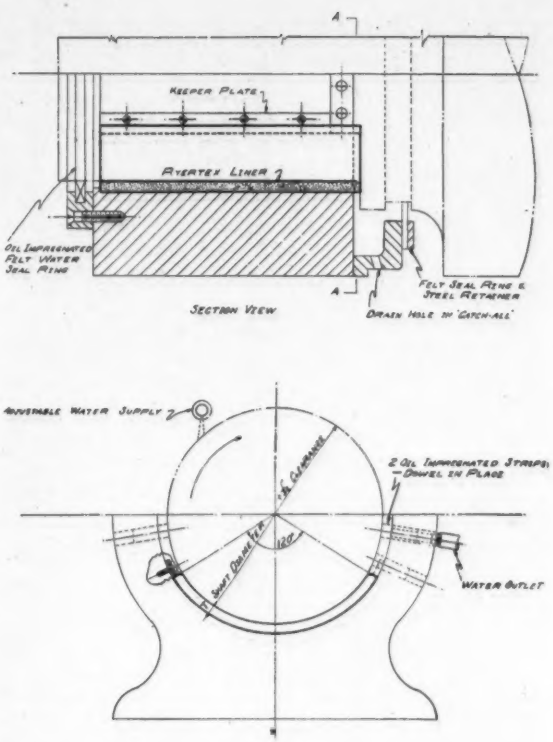


FIG. 2
Ryertex Calender Roll Bearing Design

Table IV indicates the experimental friction obtained on these materials at the low speed of 80 f.p.m., 3000 p.s.i., continuous loading, water cooling, and extreme pressure grease lubrication.

TABLE IV

Type of bearing	Coefficient of Friction: Water only	Coefficient of Friction: Water and E P grease
15-oz. laminated fabric	.054	.027
Single-ply belting	.023	.024
4-ply belting	.007	.020

The coefficient of friction figures with grease lubrication are close together, indicating a friction on the grease rather than on the bearing material. It would seem that grease lubrication offers no benefits to synthetic bearings; however, such is not the case. The maintenance of a grease film permits the roll neck to float on this film and thus reduce frictional heat and its functions of wear. Table V shows the amount of wear produced on the different grades of material under these same test conditions as above with two kinds of lubrication.

TABLE V

Type of bearing	Water cooling only: Time, hr.	Water cooling only: Wear, inches	Water cooling and E P grease lubrication: Time, hr.	Water cooling and E P grease lubrication: Wear, inches
15-oz. laminated fabric	10	.170	24	.050
Single-ply belting	10	.107	24	.026
4-ply belting	10	.109	24	.000

All above tests were conducted with bearings 7 inches in diameter by 4 inches long with 135° maximum arc of contact.

Where speed and load conditions did not encourage synthetic bearings operation with water only. The

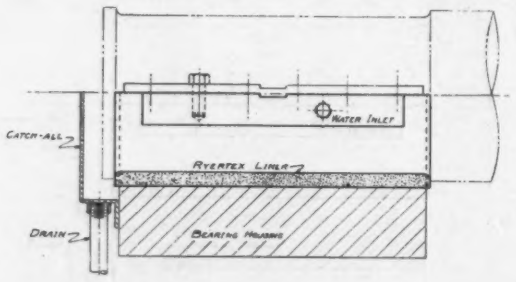
addition of the proper type of grease will permit satisfactory installations and increase bearing life. Each bearing has its own characteristics and a lubricant satisfactory for one will not necessarily be the answer to another. Some experimentation may be required on each application as well as on the different make of synthetic bearings to select the lubricant best suitable for the work. For a starting point, a grease should have a film strength in excess of the highest bearing pressure possible on the bearing, it must adhere to the roll neck and resist the wiping action produced under load, it must be nonwater soluble, and have a high melting point. We must also bear in mind that a fine film of grease is much preferred to a heavy supply of lubricant. With these points in mind the search for a lubricant is a minor problem and the benefits received will shortly repay the small amount of work involved.

Applications

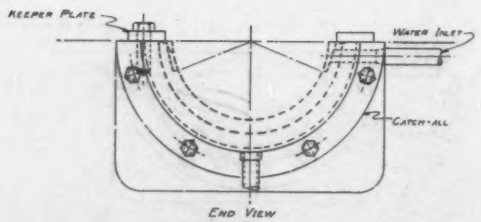
These fundamental principles can best be applied to paper mills by dividing the bearing positions into four groups, on the basis of the conditions under which they operate. They are as follows:

1. Submerged or flood water lubricated
2. Restricted or enclosed water lubricated
3. Grease and water lubricated
4. Grease or oil lubricated

The first includes bearings on such equipment as stock chests, table rolls, felt rolls, whippers, bottom press rolls, log hauls, etc. These bearings should be designed to permit the entrance of the water to the shaft. To let the water simply run over the bearing housing as it does on a whipper shaft or on a felt roll



Section View



End View

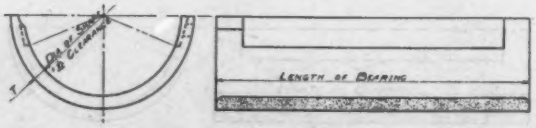


Fig. 3
Ryertex Beater Bearing

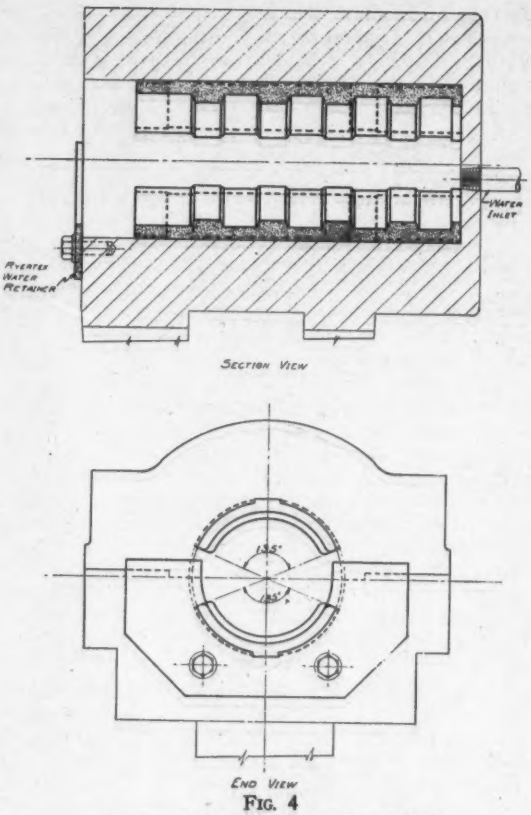


Fig. 4
Ryertex Jordan Bearing for Thrust End

is not always sufficient. A small pipe should be brought to the bearings to feed water onto the shaft. Bottom press-roll bearings that are kept wet by water coming off the sheet may not need any more water for lubrication but for safety a separate water supply should be provided.

The second includes bearings on such equipment as top press rolls, bottom calender rolls, jordan thrusts, grinders, etc. The water supply on these should be arranged so that it provides adequate lubrication without becoming a nuisance to the operator or without preventing satisfactory operation of the unit. These requirements are different as mill conditions vary; however, some conventional methods of applying water are shown below.

The third includes bearings on such equipment as slow-speed press rolls, some table and wire rolls, wet-lap machines, and some slow-speed calender rolls. Usually block grease provides the simplest form of supplemental lubrication. It should be placed on the journal so that it does not completely cover the exposed surface and prevent the water from properly removing frictional heat.

The fourth includes bearings on such equipment as drier rolls, dry table rolls, etc. These special applications are lubricated according to requirements and are mentioned here only to cover the complete range of possibilities.

Press Rolls

Figure 1 shows the top press roll bearing with felt seal rings enclosing the water chamber so that the water will not leak or run off onto the sheet but will be carried away to lubricate the bottom roll bearing.

BOTTOM CALENDER ROLLS

Figure 2 shows the location of the water supply being adjustable. This is necessary due to the need for more or less cooling depending on the pressure required on the different kinds of paper being produced. The water is restricted by a felt seal ring on the outside and another on the inside with a catch-all and drain to keep the face of the roll dry.

BEATERS

Figure 3 shows a typical installation arranged with a water catch-all on the outside to carry the water away to the drain. The bearing liner is shown chamfered to within a short distance of each end to form a pocket for water. This lubricating water may be brought to the bearing by spray pipes with small holes to spread the supply along the full length of the journal or by open-end pipes securely fastened in position over the center of the journal or through the housing into the long chamfer as shown.

JORDANS

Figure 4 shows a typical thrust bearing equipped with synthetic molded liners held in position with integral keys. These keys transmit the load to the housing and keep the liners from rotating. The opening between the top and bottom 135° liners should be kept flooded with circulating water. The water should be brought in at the outside end and released over the retainer at the plug end. An arrangement of this kind will not only conserve water but increase bearing life.

Conclusions

For successful operation of laminated plastic bearings, the following important suggestions are made:

1. Roll necks or journals should be polished smooth, free of checks, and pits.
2. Chucks or bearing housings should be strong enough to resist the maximum bending force possible on the unit and to fit bearings to a point of suction.
3. Synthetic bearings should be of heavyweight fabric.
4. Arc of contact of bearing should be just large enough to maintain roll alignment.
5. Cooling water should be adequate to remove all heat generated in operation and should be free of abrasive and chemical impurities.
6. Grease lubrication together with water as a coolant is advantageous on all low-speed, high-pressure installations. The grease film should be capable of resisting rupture even under the maximum pressures.

It is true there are many applications where the above suggestions do not apply, and again we must stress the point that many light-load conditions do not command some of the special attentions as described in this article.

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1. Synthetic resin in aircraft construction—their composition, properties, present state of development and application to light structures, by K. Riechers, National Advisory Committee for Aeronautics, Technical Memorandum No. 841, Nov., 1937.

S. H. Cook Gets Captain's Commission

[FROM OUR REGULAR CORRESPONDENT]

HAVERHILL, Mass., December 21, 1942—Stanwood H. Cook, sales-manager for the Haverhill Boxboards Division of Robert Gair Company, Inc., has received a captain's commission in the United States Marines.

Forestry Courses for War Emergency

According to a new plan students will be admitted to the New York State College of Forestry at Syracuse University for regular courses on the following registration dates: January 19-20. Classes begin January 21. Also, students may register May 31 and June 1. Classes will begin June 2. This announcement was made by Dean Samuel N. Spring of the College.

Application for enrollment should be filed with the registrar as early as possible so that the college will know approximately how many students will enter. This information will facilitate the arrangement of special courses in connection with the war emergency.

"The June registration," says the Dean, "has been made possible by the establishment of a three-term year. This means that the College of Forestry will continue its courses throughout the year. The regular summer vacation period will be taken up by the addition of the new third term."

The dean also announces that superior students who have finished satisfactorily three years or three and a half years in high school with the necessary requirements for regular or proposed special courses will be eligible for enrollment in January and in June.

There is a probability that students, due to the war emergency, may be unable to complete a full-study program in forestry. The present forestry program is being rearranged so as to deal with those subjects that will be most helpful in pre-induction or pre-industrial training. These students may return and complete their college courses after the war.

Full information may be obtained by students who desire to take advantage of this war emergency program in forestry training, by addressing the Registrar at the New York State College of Forestry, Syracuse, New York.

Norway to Get Sitka Spruce Seed

When the Norwegian government in exile returns to its homeland on some future day, it will take along 200 pounds of Sitka spruce seed culled from the dark northern forests of the British Columbia coast. The order is one of a number from Great Britain, received by B. C. this year. A total of several thousand pounds of seed was asked—enough to reforest an extensive acreage of European woodland—but it is not expected the quota will be met this season.

The reason is that the 1942 seed crop from the coast woods threatens to be a failure. Fir-seed yield is very poor, the Sitka spruce cones aren't making a much better show. In spite of the dearth, however, neither Hon. A. Wells Gray, minister of lands, nor the veteran foresters in his department are greatly concerned.

Seed crops, like salmon, come in cycles. In consequence, the Forest Service has adopted the prudent policy of storing a three-year supply each season of heavy yield giving a "bank" on which to draw.

Harvesting conifer seed is a little-known occupation which gives many a struggling stump-rancher and his family a cash lift to tide them through the winter. The service has a loose arrangement with hinterland families. During the harvesting season —from mid-September to about the third week in November—man, wife and youngsters frequently gather cones.

The Measurement and Influence of Fiber Length*

By James d'A. Clark[1]

Abstract

Anomalies in reported results for "average" length of fibers have been discussed and shown to be concerned with the inclusion or exclusion of fine material and differences in the meaning of the word average.

A rapid and accurate method of measuring the length of fibers by projection is presented and also a description of convenient means, employing a classifier and special formula, for determining the weighted average fiber length by the weight (L), *which is shown to affect the tensile strength and rigidity of paper according to* $L^{1/2}$, *the bursting strength according to* L *and the tear resistance according to* $L^{3/2}$. *These findings are believed to be correct; they are not influenced by the fineness of the fibers, which has been a complicating factor in previously published relationships. The effect of fiber length on some other properties also is indicated. A convenient method for obtaining the "titer" or fiber length per gram of pulp (a measurement of its fineness) also is discussed briefly.*

Until the beginning of the present century, apart from cleanliness and color, the length and width of pulp fibers were the only criteria of the physical quality of pulp. Until recently, with the advent of pulp classifiers, there have been no test figures which have been more quoted in textbooks and articles on papermaking but, unfortunately, less used in practice, than data on fiber length.

Definition of "Average Fiber Length"

Before proceeding, it is necessary to discuss the meaning of the expression "average fiber length" because, two of these three words require a definition—something which is not often recognized. A cursory examination of the literature reveals that almost every authority has his own, usually unexplained, ideas on the question: for example, the "average fiber length" of spruce will be found variously given in a range at least from 0.74 mm. *(1)* to 3.48 mm. *(2)*, and usually to three, or even four, significant figures. It is clear that the "average" may be computed by dividing the total length of all the fibers in a sample by the number of fibers present, which is the same as summing, over a number of intervals, the products of the percentage by number in a given interval and the average fiber length in that interval and dividing by 100. This gives the numerical average fiber length. Average lengths may be obtained also by summing over a number of intervals the products of the percentage of the projected area, or the fiber volume, or the actual weight of the fibers in each interval and the average fiber length in that interval and dividing the result by 100. Confusion has been added because some workers term the "weighted average fiber length by projected area" the *average fiber length by weight* which, of course, implies the erroneous assumption that all fibers, long or short, have the same thickness and the same density.

Especially when reporting the average length of a pulp by number, it is obvious that the result depends entirely on how small a piece of fibrous material in a pulp can be before it ceases to be regarded as a "fiber". Graff and Miller *(3)* have shown that, for nine softwoods, between 30 and 56% (by number) of the material were found in a range from 0.02 to 0.1 mm., from 19 to 41% in the range from 0.1 to 0.5 mm., and the remainder were over 0.5 mm. long. For the same pulps, the projected area of the material less than 0.5 mm. varied from 3 to 12%; evidently the short material constitutes a small proportion of the weight of the pulp.

The Minimum Length of a Fiber

Bergman and Backman *(4)* infer that the shortest fiber length to be considered should be 0.5 mm., and in this they are supported by Lampén *(5)*. Grund and coworkers *(6)* call particles less than 0.2 mm. "debris". Klemm *(7)* regards 0.1 mm. as the lower limit; Graff and Miller, on the other hand, and presumably Calkin *(1)*, consider material down to 0.02 mm. Under these circumstances, the value of "the average fiber length by number" becomes open to question, since it is no more logical to stop at 0.02 mm. than it is at 0.2 mm.; presumably, with greater care, a limit of 0.002 mm. could be established, which would more than decimate the results.

As the thickness of the average paper is in the vicinity of 0.10 mm. (0.0039 in.), there is some reason for stopping at that point, because material shorter than this cannot sensibly be held to contribute to the fiber "length" *per se;* and whereas this fine material has an important influence on the over-all pulp quality, as will be discussed later, obviously it should be classed as a filler (as far as length is concerned). One-tenth mm. is the shortest material retained by a 150-mesh screen in a pulp classifier, and this is about the finest mesh screen practicable to use, as finer ones become clogged too readily. Fibers shorter than this are considered by most users of the classifiers to be flour or debris. Furthermore, it is possible, by including the lengths of all the debris in the fiber count (material which is readily removed by washing during the bleaching operation), to arrive at the surprising result that an unbleached pulp usually increases in fiber length (numerical average) by 20% or more during bleaching. Such a result is clearly devoid of useful meaning. Finally, it should be noted that the inclusion of this fine material in an

* A portion of a thesis submitted in partial fulfillment of the requirements of The Institute of Paper Chemistry for the degree of Doctor of Philosophy from Lawrence College, Appleton, Wis., June, 1941.

[1] Member TAPPI, Research Associate, The Institute of Paper Chemistry, Appleton, Wis.

estimate of fiber length by visual means accounts for nearly half the operating time consumed.

With these considerations in mind, it is suggested that for the purposes of length measurement, a fiber be defined as an element of fibrous material, having a length of over 0.10 mm. and a projected area of over 0.10 × 0.01 mm., so that a fine thread or fiber 5 μ wide would need to be at least 0.2 mm. long to be included. This latter provision is somewhat more arbitrary, being based on the consideration that an exceedingly fine thread is too weak to contribute appreciably to strength by virtue of its length; it does so rather by its presence as an adhesive filler.

Because, in practice, pulp is always measured or blended by weight and, as will be shown later, the properties of a mixture of two pulps of different lengths depend upon the weighted average of the lengths by weight and not by number, the average fiber length of a pulp should refer to the weighted average length by true weight as far as possible. Furthermore, using a weighted average by weight has the effect of minimizing the presence of the shorter fibers, so that whether we stop at 0.1 mm., more or less, makes little difference.

The Measurement of Average Fiber Length by Weight

Beadle *(8)* was probably one of the first to suggest a workable method for determining the average fiber length by weight. He separated his sample into weighted fractions for microscopic measurement by means of a series of ordinary screens after drying the pulp and disintegrating it dry. He said (page 165):

> "Of course a measurement under a microscope of a number of fibers will give all the necessary data as to length and relative lengths, but as such examinations cannot be made in the ordinary course in the mill, and as these examinations give only the *number* [italics his] of fibers of different dimensions the microscopic method has its limitations. As we wish, among other things, to determine the percentage by weight of fibers of different dimensions, some other method is desirable."

Colditz *(9)* has suggested another procedure, but a much more promising method has recently been described by Hertel *(10)* for cotton fibers and it seems possible that a modification of his technique could be made to apply satisfactorily to pulps.

At present, the best means that we have of measuring the average fiber length by weight is the division of a pulp into a series of fractions (as many as is practicable) by means of a pulp classifier, finding the percentage by weight of each fraction, determining the average fiber length by weight of each fraction (for which an approximation must serve) and then dividing the sum of these products by 100. Brainerd *(11)* has recently presented a summary of the development of instruments and methods designed to classify pulps into fractions of different fibre lengths.

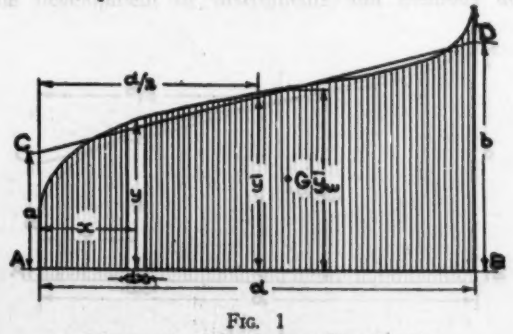

FIG. 1
Diagrammatic Arrangement of Fiber Length.

Average Fiber Length of Classifier Fractions

Because the range of fiber lengths in a classifier fraction is restricted, it becomes possible, without serious error, to convert a determination of the numerical average fiber length of each fraction into the weighted average fiber length by weight, by the following hypothetical operation. All the fibers in each fraction are arranged side by side in order of increasing length, as shown in Fig. 1, and a straight line, *CD* fairly drawn through the curve made by the tips of the fibers. The weighted average length sought for each fraction will be the length of the vertical line which passes through the centroid, or center of gravity, *G*, of the trapezoidal figure, *ABCD*, so formed. This involves the assumption that the fibers increase uniformly from a length, $AC = a$, to a length, $BD = b$. The average length by number, $\bar{y}$, is given by $(a + b)/2$. If we divide the area into a number of vertical slices, each dx in width, the weighted average length by area of the fibres in that slice will be $(y \cdot dx \cdot y)/(y \cdot dx)$, so that for the whole area, the weighted average length by area, which we will call $\bar{y}_w$, is given by the sum of the area of each slice from $x = o$ to $x = d$, multiplied by the average fiber length of each slice and divided by the whole area. Thus we can write:

$$\bar{y}_w = \frac{\int_o^d y^2 dx}{\int_o^d y dx}$$

As *CD* is assumed to be a straight line, we can write $y = a + mx$, where $m = (b - a)/d$. Therefore,

$$\bar{y}_w = \frac{\int_o^d (a + mx)^2\, dx}{\int_o^d (a + mx)\, dx} = \frac{\int_o^d (a^2 + m^2x^2 + 2amx)\, dx}{\int_o^d (a + mx)\, dx}$$

$$= \frac{a^2d + (\tfrac{1}{2}) m^2d^2 + amd^2}{ad + (\tfrac{1}{2}) md^2}$$

Substituting $m = (b - a)/d$ and simplifying, $\bar{y}_w = \frac{2}{3} \frac{a^2 + b^2 + ab}{a + b}$. The ratio of $\bar{y}_w$ to $\bar{y}$—i.e., the weighted average length by weight (area) to the average length by number is

$$\frac{\bar{y}_w}{\bar{y}} = \frac{2}{3} \frac{a^2 + ab + b^2}{a + b} \times \frac{2}{a + b} = \frac{4}{3} \frac{a^2 + ab + b^2}{(a + b)^2}$$

Dividing by a^2 we obtain

$$\frac{\bar{y}_w}{\bar{y}} = \frac{4}{3} \frac{1 + \frac{b}{a} + \left(\frac{b}{a}\right)^2}{\left(1 + \frac{b}{a}\right)^2} = \frac{4}{3} \frac{1 + r + r^2}{(1 + r)^2}$$

where $a/b = r$. Thus if we know the ratio, r, we can make an approximate correction, which is relatively easily determined, to the numerical average length so as to convert it to the weighted average

length by area, which, for some practical purposes —for example, determining the average length of classifier fractions—may be regarded as the weighted average length by weight.

In practice, because of the presence in every fraction of a few stray fibers that are very short or very long, it appears best to find the ratio (r) by discarding the longest 2.5% and the shortest 2.5% of the fibers, finding the average length of the next longest and shortest 5% of the fibers situated at either end, and then to increase the ratio r of the longest to shortest fibers by 10% (2.5 + 2.5 + 5.0), which procedure will be clear from a consideration of the geometry of Fig. 1.

As a result of a number of experiments it was found that, for most practical purposes, the ratio of the weighted average fiber length by weight to the numerical average fiber length could be taken to be 12.5% for the intermediate fractions from a classifier having a series of screens with 20, 35, 60 and 150 meshes per inch. Moreover, it was found that the average lengths of the intermediate fractions were practically constant for all the pulps examined and later work has disclosed that little error would be made by assessing the values of 1.75, 1.00, and 0.55 mm. for the weighted average fiber lengths of the intermediate fractions of at least all coniferous chemical pulps and using a figure of 0.05 mm. as the average weighted length of the "debris" or "through 150 mesh" fraction. The weighted average length of the longest fraction cannot be assumed, as this clearly depends upon the type of pulp and its degree of beating. The weighted average length of the debris probably also increases with beating, but, in general, the effect of this fine fraction on the weighted average length of the whole pulp is so small that no appreciable error would result if the average lengths of the debris were taken to be 0.05, 0.1, and 0.2 mm. for moderately beaten pulp, well beaten pulp, and groundwood, respectively.

Measuring the Length of Fibers

Graff and Miller (*3*) have given an excellent summary of various methods employed to measure fiber lengths, including a detailed description of an accurate microscopical method developed by Graff. However, as this method takes at least one and one half hours to complete, a new projection method was developed by which over 200 fibers in a sample may be accurately measured and recorded in less than half that time.

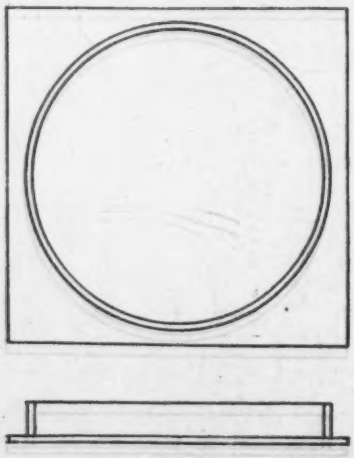

FIG. 2
Plan and Elevation of Cell for Specimen.

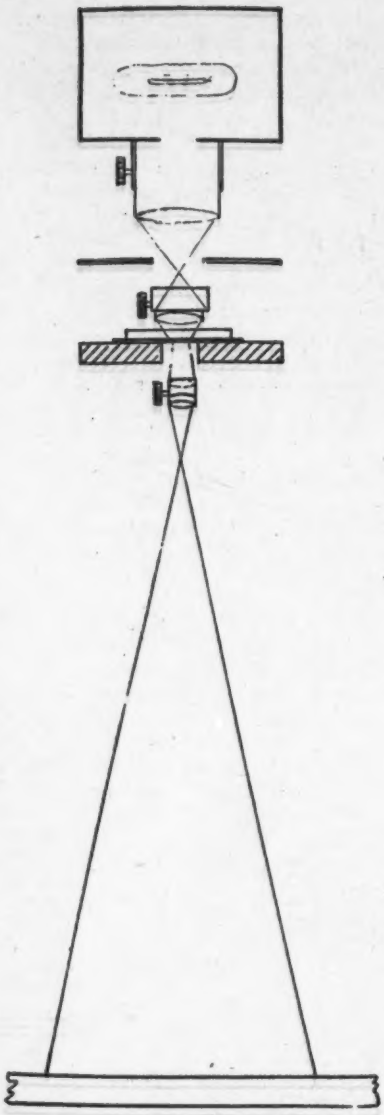

FIG. 3
Diagram of Projection Apparatus.

In brief, the new method is as follows: A dilute suspension of the sample (about 0.1 gram per liter) is prepared and, using a 6-mm. diameter pipet made of glass tubing with a small rubber bulb at one end, about 4 cc. of the suspension is transferred to a special cell (Fig. 2). This cell is made from a piece of flawless glass on which an annular ring of metal or glass 6 or 8 cm. in diameter and about 1 cm. deep is cemented. The inner sides of the ring preferably should be painted with a water repellent (aluminum stearate solution is excellent), so as to keep the surface of the suspension fairly flat. Two or three cc. of a 0.5% solution of locust bean gum in water is added to the fibers in the cell. The solution is made by heating one gram of gum in 200 cc. water to 80 deg. C. with stirring and, after cooling,

adding a few drops of formaldehyde as a preservative. The function of the gum is twofold: it disperses and also immobilizes the suspended fibers, thus making the procedure both convenient and accurate.

The cell and fibers are then placed in a vertical projection apparatus as shown in Fig. 3, the magnification of which has been previously accurately adjusted so that a pair of parallel lines on a slide 5.0 ± 0.01 mm. apart (Fig. 4) exactly coincide with two sides of a four-inch square (subdivided into one-inch squares) drawn on the horizontal screen as shown in Fig. 5.

On the screen is placed a piece of semitransparent manifold paper about 8 by 10.5 inches which has been ruled lengthwise with a parallel series of light pencil lines about ¼ inch apart, and with a pair of heavier parallel lines at the top and bottom of the sheet exactly 10 inches apart. This also is shown in Fig. 5.

After adjusting the focus, if necessary, to secure sharp images of the fibers, the following procedure is recommended: Starting at the upper left-hand one-inch square ruled on the screen, move the paper so that the tip of a fiber coincides with the point at the top left-hand corner of the paper where the lines intersect. Move the paper so that the light line coincides as nearly as possible with the fiber being measured. If the fiber curves away from the line, rest the point of a sharp hard pencil at the place on the light line where the curvature starts and, using the pencil point as a pivot, push or pull the paper until more of the fiber coincides with the line; then move the pencil point to the place where the fiber curves off again. In this way, the image of any fiber, no matter how curled, may be accurately straightened out. Mark the light line with a stroke where the other end of the fiber stops and proceed to record the length of the next fiber. Do this in turn for every fiber which has an end lying in the top right-hand square and which has more than one half of its length inside the four-inch square. Proceed to the second top left-hand square and record the lengths of all the fibers whose ends lie there and which do not originate in the first square. Similarly, record all the fibers in each of the 16 squares which have more than half of their lengths lying in the big square and omit only those whose

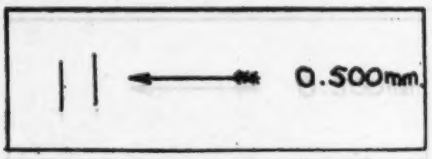

FIG. 4
Gage for Magnification.

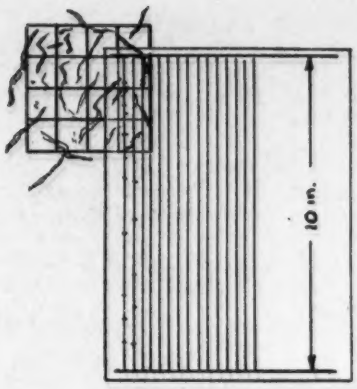

FIG. 5
Ruled Paper Over Screen.

image is 2 mm. or less long, corresponding to those shorter than 0.1 mm., or those fiber particles having an image area of less than 0.001 sq. mm. When dealing with classified pulp, other than the very fine fractions, ignore the presence of tiny or very short fibers, even longer than 0.1 mm., if only one or two are visible in the entire field.

When the bottom of a light line is reached on a fiber, note the place on the fiber by making a mark, if necessary, on the screen; then move the paper up to the top of the next line and continue. Marks made on the screen for this purpose should be erased as soon as possible.

Without looking at the screen, move the cell to a new position. Again record all the fibers lying more than one half within the four-inch square, counting the fibers mentally as they are recorded and writing on the paper against the mark of the end of the last fiber examined in each four-inch square field, the number of fibers in that field. In this way record the lengths of about 200 fibers, which, if of average length, will be found in about 10 fields.

Measure the total length of the fibers recorded by counting the number of 10-inch lines filled and measuring the length of the partially filled final line, and divide the total length in inches by the magnification factor (0.8 with the specified conditions) and by the number of fibers examined, to obtain their average length in mm.

If desired, the longest and shortest fibers may be picked out from the record and marked to be measured individually and thus secure the ratio r for use in the special formula for weight correction.

Measuring the "Titer" of Pulp

It will be seen that with this procedure, if care is

TABLE I.—CHANGES IN FIBER LENGTHS ON BEATING

Fraction	Classifier Screen Opening × 4.0 mm.	Unbeaten			8 r.p.g.*			32 r.p.g.			64 r.p.g.		
		% by Weight	Av. Weighted Length	Product	% by Weight	Av. Weighted Length	Product	% by Weight	Av. Weighted Length	Product	% by Weight	Av. Weighted Length	Product
Long	3.3	66.2	3.24	214.5	45.1	3.21	144	15.8	2.94	46.5	6.8	2.74	18.5
Medium	1.67	11.6	1.74	20.0	20.1	1.68	34	24.7	1.81	44.5	22.1	1.76	39.0
Short	0.83	7.0	1.00	7.0	15.0	0.95	14	21.1	0.83	17.5	24.2	0.95	23.0
Very Short	0.42	4.2	0.48	2.0	9.9	0.45	4.5	13.3	0.43	6.5	17.6	0.42	7.5
Debris	...	11.0	0.05	0.5	11.9	0.05	0.5	23.1	0.05	1.0	29.3	0.05	1.5
Weighted Av. Length by Weight			2.44 mm.			1.97 mm.			1.16 mm.			0.89 mm.	
Numerical Av. Length**			1.49 mm.			0.95 mm.			0.63 mm.			0.57 mm.	
Ratio Weighted Av. Length by Weight to Numerical Av. Length			1.6			2.1			1.8			1.6	
Titer, cm./g.			370,000			600,000			660,000			720,000	

* r.p.g. = revolutions of the kollergang rolls per gram of pulp treated.
** Fibers shorter than 0.12 mm. not included.

taken to dilute the pulp sample to an accurately known consistency and if an accurate quantity of this suspension is transferred to the cell for examination, an estimate of the "titer," or length of fiber per gram of pulp, may be obtained easily from the total length of all the fibers examined, the number of fields employed for the estimate, and the area of the cell. This figure is of greater value as a measurement of the "fineness" of pulp than is a measurement of the average fiber width, which of course requires a microscope; and is also only one of several factors, including the thickness of the fiber and its lumen, which influence the "fineness".

Table I gives the changes in the classification and average length of the fractions of a bleached West Coast sulphite pulp with beating. The "titer" of the pulp at each stage, after stuitably correcting for the percentage of debris removed by the classifier, also is given. The latter figures indicate that little complete splitting and separation of wood fibers has been effected in contrast with bast fibers, such as linen, where, with beating, the titer would probably increase many fold.

The Effects of Fiber Length on Sheet Properties

Some data are to be found in recent literature *(11, 12)*, on the effect of fiber length on sheet properties, but in every case the effects are obscured by the fact that fractions from the classifier were used for the purpose. As is well known, the shorter-fibered fraction also differs from the longer ones by being composed of much finer—i.e., thinner—fibers, and the finest fraction usually contains the wood cells and ray tracheids and even differs chemically *(14)*.

To insure that the only variable in the following tests was length, a somewhat tedious but quite effective procedure was employed, in which a quantity of bleached sulphite was fractionated and only the material in the long fraction was further used. Sheets of the long-fibered fraction were cut fine with a sharp knife and the cut pulp reclassified into several fractions.

After testing sheets made from each fraction for various properties, the pieces from the test sheets were gathered, mixed with some fresh, long-fibered stock, stirred for 300,000 revolutions in the British disintegrator at 2.4% consistency, again fractionated, made into sheets, and tested. All these results are given in Table II and Figs. 6 and 7; some of these are plotted on a log-log basis in Fig. 8.

A single sheet was made with 50% by weight of the longest and the shortest fractions of the beaten stock. The tests obtained are seen to lie quite close to the "medium" sample having a weighted average length of 1.80 mm. For every long fiber in the mixture, there would be 3.08/0.545 = 5.65 short fibers, so that its numerical average length would be 2 × 3.08/6.65 = 0.925 mm., or about the weighted average length of the "fine" fraction, to which it bears little resemblance. This validates the use of the average weighted length by weight as the proper measurement of fiber length.

The Effects of Fiber Length on Sheets Made from Viscose Silk

A quantity of viscose artificial silk was cut up by means of a sharp guillotine into 20-gram portions nominally from 0.5-1 mm., 1.5-2 mm., 2.5-3 mm., 3.5-4 mm., and 4.5-5 mm. long, and each was diluted with water to give 5 stocks having different lengths. After a number of trials with various mucilages as a binding medium, the following procedure was found to be moderately satisfactory. To each 20-gram sample in about 1.5 liters of water was added 5 grams (dry weight) of locust bean gum dissolved in warm water and then 2 grams (dry weight) of alum solution. The whole was diluted to 2 liters and stirred for 15,000 revolutions in the standard disintegrator. Each sample was made into test sheets by the standard procedure. The sheets were tested[2] for tensile, tear, rigidity, and specific volume. The first three are plotted on a log-log basis in Fig. 8.

It will be noticed that the plotted results in Figs. 6, 7, and 8 are entirely different from those published by Doughty *(12)* and other investigators who used the different fractions of a whole pulp from pulp classifiers for this purpose. The reason, no doubt, is that the shorter fractions from the classifiers are so much finer that the effects of fiber length alone were not only obscured but also in most instances reversed. Perhaps the most striking thing is that, despite the

[2] For these results the author is indebted to S. P. Moore of the Scott Paper Company for his skillful assistance and to the Company for permission to publish the data.

TABLE II.—SUMMARY OF DATA ON EFFECT OF FIBER LENGTH

	Unbeaten Fractions				Beaten Fractions				
	1 Long	2 Medium	3 Fine	4 Very Fine	1B Long	2B Medium	3B Fine	4B Very Fine	Mixture 50%-1B 50%-4B
Basis Weight—g./sq. m.	61.1	62.9	59.2	63.0	68.5	68.2	63.7	65.0	63.7
Thickness—0.001 in.	5.26	5.44	4.16	5.45	5.26	5.30	4.89	4.94	4.7
Apparent Specific Volume—cc./g.	2.18	2.20	2.22	2.20	1.95	1.97	1.95	1.93	1.87
Apparent Density—g./cc.	0.458	0.455	0.451	0.455	0.513	0.508	0.513	0.518	0.535
Burst—lb./sq. in.	4.7	(2.3)	2.2	2.2	13.8	7.8	4.2	2.42	....
Tear—g./sheet	31.2	12.8	7.2	6.4	111	48.6	15.0	7.4	....
Tear Factor	51	20	(12)	(10)	163	71	24	11	....
Tensile—lb./15 mm.	1.33	0.98	0.63	0.71	4.05	3.02	2.18	1.63	2.80
Breaking Length—m.	660	470	330	340	1780	1330	1030	750	1320
Zero Span Tensile—lb./15 mm.	18.2	16.1	12.2	11.3	23.4	22.2	17.6	15.5	20
Zero Span Breaking Length—m.	9500	7700	6200	5500	10,300	9800	8300	7200	9500
Breaking Length/Zero Span Breaking Length—% Adhesion	7.3	6.1	5.2	6.3	18.1	13.6	12.4	10.5	14.0
Adhesion (Shear)—kg./sq. cm.	....	....	....	....	1.36	1.13	1.09+	Broke	....
Adhesion (Split)—g./sq. cm.	....	....	....	....	17.5	15	15	Tore	....
Stretch—%	....	....	....	....	2.09	1.06	0.71	0.35	....
Absorbency—sec.	2	....	....	....	6	....	....	8	....
Klemm Test—mm. rise in 10 mm.	11.4	....	....	12.4	9.0	....	....	9.0	....
Porosity—cc./sec.	580	670	580	445	270	275	235	220	....
Rigidity Factor	7.2	4.4	3.6	3.1	23	18.8	15.1	10	....
B. & L. Opacity readings	67.5/ 96.2	68.5/ 96.2	70.2/ 96	71.5/ 96.1	69/ 96.5	70/ 96.5	71/ 96.5	72/ 95.5	70/ 96.5
TAPPI Opacity at 60 g./sq. m.	69.7	70.2	73	73.4	68.1	69.1	72.2	73.5	71
Canadian Standard Freeness—cc.	750	755	760	735	720	....	720	640	....
Wet Specific Volume—cc./g.	18.7	17.6	14.8	13.5	17.4	16.1	14.2	11.8	....
External Specific Surface—sq. cm./g.	7300	....	....	....	9960	....	....	10,050	....
Weighted Average Length—mm.	2.78	1.80	0.73	0.52	3.08	1.80	0.92	0.54	1.81

Note: Sheets made and tested in accordance with TAPPI Standard T 205 m.

wide differences in the wet specific volumes of the pulps (obtained by a modified Klemm sedimentation test), most unexpectedly, the dry specific volumes of the test sheets in both pulp series is identical. This was not the case for the papers made from viscose silk, however, as there the dry specific volume increased almost linearly with length from 3.47 cc./g. for the shortest fraction (1.43 mm.) to 4.02 cc./g. for the longest fraction (4.0 mm.), possibly because of the longer and relatively stiffer fibers and especially because of the absence of fibrillae on their surfaces.

It will be seen that for the two series of pulps (Fig. 6), the burst factor is quite accurately proportional to the weighted average fiber length by weight *(L)*—i.e., the burst factor $= k_1 L$, where k_1 is a constant. This excepts the results for the two shortest fractions of the unbeaten pulp which were definitely in error because the minimum reading obtainable with the particular motor-driven Mullen burst tester used for these tests was 8.5 p.s.i.

When the different tensile strengths, the rigidity factors, and the tear factors of both series of pulp test sheets and also those made from artificial fibers are plotted against fiber length on a log-log basis (Fig. 8), it will be seen that, within experimental error, all the lines are straight. By measuring their slopes the following common relationships are derived:

$$\text{Breaking length} = k_2 L^{1/3},$$
$$\text{Rigidity factor} = k_3 L^{1/3},$$
$$\text{Tear factor} = k_4 L^{2/3},$$

and, as noted previously,

$$\text{Burst factor} = k_1 L.$$

The results for opacity are somewhat anomalous and may be due in part to the absorption of dirt or coloring matter in the shorter fractions, especially of the "beaten" pulp, because of the somewhat prolonged and involved handling which all these pulps received while being cut, classified, and reclassified.

Because the specific volume of the sheets of each series remains constant, it would appear from the opacity results, if these are trustworthy, that there were more fiber-to-fiber areas in contact in the case of the longer fibers, perhaps because of a better orientation in the plane of the paper. It is notable that the "adhesiveness" of the longer-fibered sheets as measured is greater than that of the shorter-fibered sheets, which may also be significant in this connection.

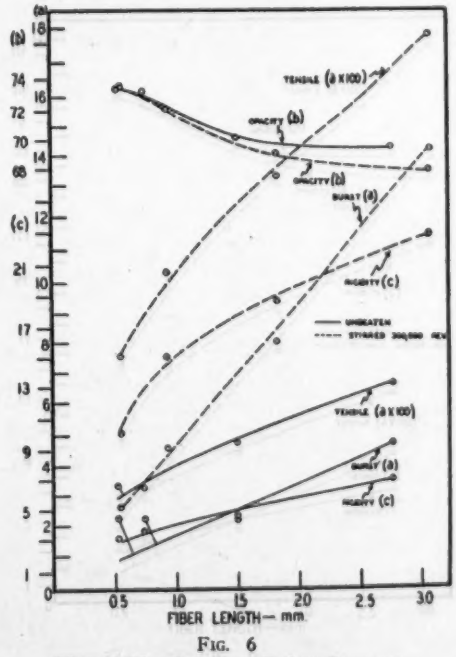

FIG. 6
Effect of Fiber Length on Various Properties.

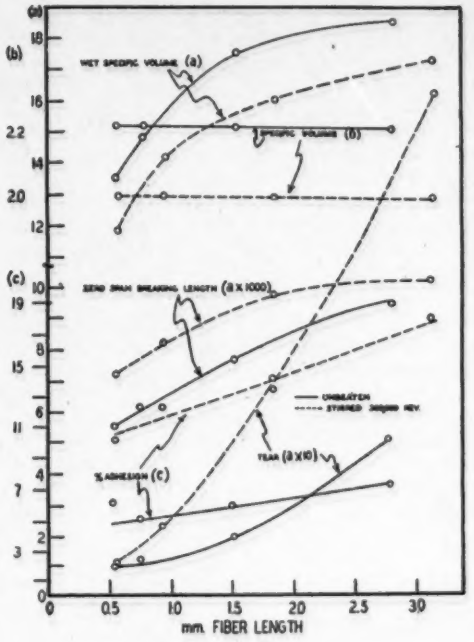

FIG. 7
Effect of Fiber Length on Various Properties.

The slight increase of the zero span tensile tests *(13)* of the longer-fibered sheets may be caused by better orientation in the plane of the paper but more probably is bound up with the nature of this test, a

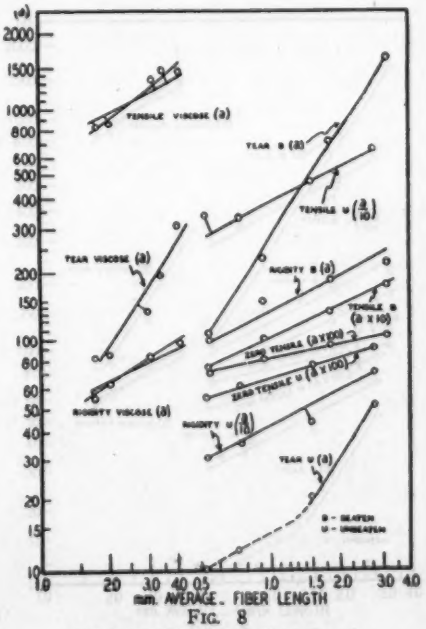

FIG. 8
Relation of Strength to Fiber Length.

discussion of which is beyond the scope of the present paper.

Conclusions

Except for trivial purposes, a report of the numerical fiber length of pulp, especially if debris is included, is of no value. Fiber length measurements should be, as accurately as is practicable, a measure of the weighted average fiber length by true weight. A measurement of the length of fibers may be accomplished far more rapidly than with a microscope and very accurately, by a modified projection procedure which has been developed.

Fiber length is a fundamental measurement of pulp quality and has an important bearing on sheet properties. Previously, the effect of length has not been isolated from the commonly associated property of fiber fineness. It appears that tensile strength and sheet rigidity are proportional to $L^{1/2}$ (where L is the weighted average fiber length by weight), the bursting strength is proportional to L, and the tearing resistance to $L^{3/2}$. The density of the sheet does not seem to be affected.

Further work on the relationship between fiber length and other sheet properties and tests remains to be done.

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TAPPI Notes

Frank J. Lang, formerly of the International Paper Company, is now general manager of the Dexter Sulphate Pulp and Paper Company, Dexter, N. Y.

James d'A. Clark is now a Major in the Chicago Quartermaster Depot, Subsistence Research Laboratory.

A. M. Cadigan, formerly of the St. Regis Kraft Company, is now chief chemist for the Pulp and Paper Products Division of the Cellulose Products Laboratory, Tacoma, Washington.

William G. Surridge, formerly of the Celotex Company, is now with the United Paperboard Company, Lockport, N. Y.

The TAPPI Pacific Section will meet at Longview, Wash., on January 5th, 1943.

Harvey P. Cannon is on leave of absence from the Mutual Paperboard Company, Utica, N. Y., and is in the Civil Air Patrol, 2nd Low Target Squadron, Mitchel Field, N. Y.

Morris Housen, president of the Erving Paper Mills, is now a Major in the United States Army.

The TAPPI Lake States Section will meet at the Conway Hotel, Appleton, Wis., on January 12, 1943. The meeting will be held jointly with the Northeast Wisconsin Section of the American Chemical Society. F. A. Weymouth of the International Printing Ink Company, will talk on "The Changes of Printing Ink Due to the War Effort."

D. B. Kuhe, formerly of the Union Bag and Paper Mills, is now superintendent of the North Carolina Pulp Company, Plymouth, N. C.

W. A. (Spike) Kelley, formerly of E. D. Jones & Sons, is now a Lieutenant Colonel in the U. S. Signal Corps, Pentagon Building, Washington, D. C.

George A. Ritter, formerly of the Herty Foundation Laboratory, is now Principal Commodity Standards Specialist of the Standards Division, Office of Price Administration, Washington, D. C.

The TAPPI Empire State Section will meet at the University Club, Syracuse, N. Y., on January 8, 1943. R. T. Barnes of the International Nickel Company, and Allen Lowe of the Sandy Hill Iron & Brass Works, will be the speakers.

The Pulp and Paper Division of the War Production Board is now located in the Fisheries Building, Washington, D. C.

Industrial Chemistry

The Reinhold Publishing Company has recently issued the 4th edition of Industrial Chemistry by Emil R. Riegel of Buffalo University. This is an elementary treatise for the student and general reader (850 pages, 6 x 9, 50 chapters, illustrated).

The chapters in cellulose, pulp and paper and synthetic fibers have been brought up to date. As stated by the author "more than ever has it become evident that the well being, not to say safety, of the nation is linked to the level of its industrial chemical achievements." At the moment, it is to the chemical engineer, seconded by the chemist and able management, that all eyes turn in the quest for the substitutes for Malayan exports.

The contents cover every phase of the industries utilizing chemical processes. They include acids, alkalies, ceramics, fuels, water, fermentation, dyes, oils, pigments, soaps, explosives, plastics, glue. Other subjects include control instruments, materials of construction, pumps, blowers, filters, evaporators, driers, etc.

Copies may be obtained from the Book Department of the Technical Association of the Pulp and Paper Industry, 122 East 42nd street, New York, N. Y., at $5.50 per copy.

St. Regis Closes Pulpwood Terminal

WADDINGTON, N. Y., December 19, 1942—The local pulpwood terminal owned by the St. Regis Paper Company has suspended operations for the year after enjoying an unusually busy season. It was announced that about 38,000 cords of pulpwood had been unloaded here during the season. About 35 vessels docked here with pulpwood during the season despite transportation difficulties which have resulted in the requisition of a large number of cargo ships by Canada. From here the shipments have been hauled by rail to the mills of the St. Regis concern in various parts of Northern New York. It is expected that operations will be resumed at the local terminal the latter part of next spring. With the exception of Ogdensburg, site of the Algonquin Paper Mills, the terminal at Waddington has been the only terminal on this side of the St. Lawrence River receiving pulp shipments, all of which come from Canada.

IMPORTS OF PAPER

NEW YORK IMPORTS

WEEK ENDING DECEMBER 19, 1942

PAPERSTOCK

——, ——, ——, 395 bls. cotton linters.

GLUESTOCK

——, ——, ——, 35 bls.
——, ——, ——, 200 bls.

To Work for Better Containers

In response to the demands of the Army for more satisfactory containers for dehydrated foods, a group of industry executives have set up an informal committee to "pool" data and experience on the subject. One of the principal problems of the dehydrated foods industry has been the development of a substitute for the hermetically sealed container of tin, now in extremely short supply. Various individual companies have been studying the matter for some time.

Cooperating firms thus far enrolled in the new group, under the chairmanship of Robert D. Harper of Johnson & Johnson, Inc., New Brunswick, N. J., include the following: McCormick & Co., Baltimore, Md.; Arkell Safety Bag Company, Chicopee Manufacturing Company, Utility Fabrics Company, Beech-Nut Packing Company and Clopay Company of Cincinnati, Ohio.

The chief concern of the group, it was said, is to find quickly a container that is not only waterproof but also sufficiently moisture-tight to prevent penetration of dampness and the sogginess that results when dehydrated foods are transported through foggy regions. Such containers must also withstand shocks, tear, insects and rodents. In addition, the protective elements used against vermin must not by taste or smell affect the taste of the contents. Military urgency in North Africa and the Southwest Pacific, it was added, has created a need for such a container, "immediately, perfectly and cheaply."

The Army's standards for the satisfactory container are even more severe than those stated, it was reported. At a recent trade meeting here, Lieutenant Matthew E. Highlands of the Subsistence Research Laboratories, Chicago Quartermaster Depot, explained that the Army was not satisfied with the packages now available.

"A satisfactory container for such items," he said, "must possess the following qualities: It should be moisture-vapor-proof, water-proof, insect proof and vermin proof; and in certain instances, we believe it should be gas-proof."

Scott Paper Sales Increase

[FROM OUR REGULAR CORRESPONDENT]

PHILADELPHIA, Pa., December 21, 1942—D. A. Prouty, retail sales manager for Scott Paper Company, reports an increase in the company sales from about $23,000,000 in 1942 to $25,000,000 in 1942. He said the plant was now working around the clock seven days a week. Mr. Prouty was one of three company executives who spoke when the Sales Managers' Association of Delaware County was the guest of Scott Monday last. The other two speakers were G. N. Gordon, sales personnel manager, and G. A. Duff, industrial advertising manager. George H. Swatek, industrial sales manager, served as chairman.

Indianapolis Demand Good

[FROM OUR REGULAR CORRESPONDENT]

INDIANAPOLIS, Ind., December 21, 1942—Demand for most grades of paper in this area continued good last week. Due to an unprecedented retail business during the week, many of the larger dealers found themselves running short of both wrapping paper and bags. Gift boxes also were becoming scarce and there was a general scurrying for new supplies and for immediate delivery. The result was that local jobbing houses found the demand heavier than they had expected. Inventories in these lines will be very low the first of the year and in some instances entirely depleted.

Items in the fine paper field generally are moving well with prices firm.

Container factories are working virtually to capacity, or as much as they are permitted because of the raw material situation. Many of these factories are putting out new items to replace wooden containers that are becoming scarce. This particularly is true in the produce field, where egg cases and fruit and vegetable cases now are being made of paper and fiber board. These new items are finding a good reception.

Tissues moved well last week as did all craft items. Newsprint continued to be sold in volume, due largely to the increased holiday linage. What will happen after the first of the year is subject to some speculation here. There are many who believe advertising will sink because of lack of merchandise to advertise.

In the rag market, better grades were moving and roofing rags also were reported in demand with prices hugging the ceiling. Paper waste was slightly more in demand, but many mills appeared indifferent and local stocks were heavy.

Paper and Cordage Men Hold Party

[FROM OUR REGULAR CORRESPONDENT]

PHILADELPHIA, Pa., December 21, 1942—The Philadelphia Paper and Cordage Association, as is customary, held its annual Christmas party at the Arcadia on Tuesday last, at which the members were hosts to 60 underprivileged children from the Settlement House of the Salvation Army. The Ladies' Auxiliary of the association, comprising Mrs. E. L. Richards as president, and her co-workers, Mrs. Lee Johnson, Mrs. George K. Hooper, Mrs. E. K. Lay, Mrs. Harry S. Platt, Mrs. Jack Howarth, Mrs. David L. Ward, Mrs. Howard Bancroft, Mrs. Richard Culverhouse, and Mrs. George Corse, worked unstintingly to make the party the success it was. Each child was treated to a turkey dinner, and after an elaborate program of entertainment, Leonard Fitzgerald, in the guise of Santa, presented each child with articles of clothing, toys, candy and games. Rev. Croswell McBee, pastor of St. David's Church, Devon, was on hand as usual to pronounce the benediction.

Boston Paper Stock Market Strong

[FROM OUR REGULAR CORRESPONDENT]

BOSTON, Mass., December 21, 1942—in the paper stock market, old papers are very strong, with the low grades much firmer. Bagging is inactive.

Roofing stock is selling at ceiling prices, with all available readily absorbed.

New York Paper and Pulp Market Review

Paper Demand For Many Grades is Reported Well Above Production—Pulp Market Steady—Lower Grades of Waste Paper Improved, With Old Corrugated Boxes Quite Active—Rags Firm.

Office of the PAPER TRADE JOURNAL.
Wednesday, December 23, 1942.

Apprehension of short supplies in all major types of paper and paper products, as in many other lines, is quite widely reported to be the basis for a considerable part of the current active demand in the wholesale market. Uncertainty of ability in the future to supply orders now booked, because of further expected curtailment in output and transportation difficulties, is also apparent in reports received this week from many manufacturers' representatives, jobbers, and general paper merchants.

The index of general business atcivity for the week ended December 12, rose to 134.5%, from 133.7% for the preceding week, compared with 134.1% for the corresponding week last year. Paper board production was 6.5% higher.

Paper production for the week ended December 12 was estimated at 86.7%, compared with 106.3% for 1941, with 83.3% for 1940, with 97.7% for 1939, and with 81.2% for the corresponding week for 1938.

Paper board production for the week ended December 12 was 84.0%, compared with 101.0% for 1941, with 79.0% for 1940, with 79.0% for 1939, and with 65.0% for the corresponding week for 1938.

The index of the value of manufacturers' inventories for October, 1942, according to the Department of Commerce, which is the latest report now available, gives the total of all industries at 175.9, compared with 148.2 for October, 1941. The index for paper and allied products for October, 1942, was 149.6, compared with 128.5 for October, 1941.

The same source gives the index of the value of manufacturers' shipments of paper and allied products for October, 1942, was 148, compared with 169 for October, 1941.

Shipments of paper and allied products up to and including October, 1942, were 12% below 1941. The report explains that heavy demand for paper and paper products continued into 1942, as fears of future shortages caused buying in excess of actual requirements. As a result, the summer lull in sales was larger than usual and the seasonal rise since July has not quite attained the volume reached in 1941.

Other reliable sources indicate that orders during October, 1942, were about 6% above production. Estimates for November indicate orders were from 6% to 10% above production.

Wood Pulp

Demand for prime grades o. bleached chemical pulp continues active and above available supplies. Fair to moderate demand is rather widely currently reported in all other grades of pulp.

Rags

Mill buying of new cotton rags is reported steady this week. Prices are only moderately firm and no important changes have occurred at this date.

Old Rope and Bagging

No important change in the market situation of old rope has been reported this week.

Trading in scrap bagging is slow, with all prices continuing to reflect a nominal character.

Old Waste Paper

More firmness under increasing activity in old waste paper, is currently reported. Prices on No. 1 mixed and on folded news are firmer. Old corrugated boxes are also in more active demand, with a few sales reported at the ceiling price of $16.50 per ton.

Twine

No important change in the cordage and twine market has been reported this week. Prices are firm on all grades of hard and soft fiber twines. Certifications are required on all orders of twine manufactured from scarce, imported fibers.

Ferdinand J. L. Hoss Honored

BOSTON, Mass., December 21, 1942—Ferdinand J. L. Hoss, secretary and assistant treasurer of Stone & Forsyth Company, dealers in wrapping paper and twine and manufacturers of folding boxes, with offices at 67 Kingston street, was honored by a testimonial dinner with more than 100 fellow employees and friends attending, at the Hotel Bradford, Thursday evening, December 10, on the completion of 50 years of service with the company.

Mr. Hoss was presented with an inscribed watch commemorating the occasion by A. A. Gilmore, dean of the company's traveling salesmen, and also with a plaque, autographed by all the office girls, by Miss Katharine McAdam.

Robert M. Stone, president of the company, who presided, further surprised Mr. Hoss by handing him a War Bond for $1000. Salesman William F. Cole kept the gathering entertained and led the singing.

The honored guest, who started his career as entry clerk, lives in West Roxbury, Mass.

Paper in Battledress

WASHINGTON, D. C., December 23, 1942—A three-day exhibition entitled, "Design for Economy—Paper in Battledress," was held in London under he sponsorship of the Waste Paper Recovery Association. Some 50 displays showed what has been done in the use of paper and board, according to a report to the Commerce Department.

George J. Wallace Enters Service

BOSTON, Mass., December 21, 1942 — George J. Wallace, for several years manager of the sales department of Storrs & Bement, will leave December 22 for service in the United States Army. Mr. Wallace joined the Storrs & Bement Company in 1928.

MISCELLANEOUS MARKETS

Office of the PAPER TRADE JOURNAL,
Wednesday, December 23, 1942.

BLANC FIXE—Prices on blanc fixe are firm and unchanged and conform to prevailing market levels. The pulp is currently quoted at $40 per ton, in barrels, at works; the powder is currently quoted at $60 per ton, f.o.b., works. Demand reported good for the week.

BLEACHING POWDER—Quotations on bleaching powder are firm. Demand reported active for the week. Bleaching powder is currently quoted at $2.25 per 100 pounds, in drums, at works.

CASEIN—Prices on casein are unchanged for the current week. Standard domestic casein, 20-30 mesh, is currently quoted at 19 cents per pound; 80-100 mesh, at 19½ cents per pound. All prices in bags, car lots. Argentina casein, 20-30 mesh, at 7 cents per pound, c.i.f., is nominal. No quotations on French casein.

CAUSTIC SODA—Quotations on caustic soda continue unchanged at prevailing market prices. Demand reported fair. Solid caustic soda is currently quoted at $2.30 per 100 pounds; flake and ground at $2.70 per 100 pounds in drums, car lots, at works.

CHINA CLAY—Prices on china clay are firm and conform to prevailing market levels. Demand reported moderate at this date. Domestic filter clay is currently quoted at from $7.50 to $15 per ton; coating clay at from $12 to $22 per ton, at mines. Imported clay is currently offered at from $13 to $25 per ton, ship side.

CHLORINE—Quotations on chlorine are firm and unchanged. Market strong. Government demand is reported heavy during the current week. Chlorine is currently quoted at $1.75 per 100 pounds, in single-unit tank cars, f.o.b., works.

ROSIN—The rosin market is reported firm for the week with lower prices on some grades. "G" gum rosin is currently quoted at $3.39 per 100 pounds, in barrels. Savannah "F" wood rosin is currently quoted at $3.38 per 100 pounds, in barrels. New York. Seventy per cent gum rosin size is quoted at $3.61 per 100 pounds f.o.b., works.

SALT CAKE—Prices on salt cake are firm. Demand moderate for the current week. Domestic salt cake is currently quoted at $15 per ton, in bulk; chrome salt cake at $16 per ton. Restrictions on chrome cake removed. All prices in car lots, f.o.b., shipping point. The quotation of $16 per ton on imported salt cake is nominal.

SODA ASH—Quotations on soda ash are firm and continue to conform to prevailing market levels. Demand reported good for the week. Prices on soda ash in car lots, per 100 pounds, are as follows: in bulk, $.90; in paper bags, $1.05; and in barrels, $1.35.

STARCH—Prices on corn starch are reported unchanged for the current week. Pearl is currently quoted at $3.10 per 100 pounds; powdered starch at $3.20 per 100 pounds. All prices in bags, carlots, f.o.b., Chicago.

SULPHATE OF ALUMINA—Quotations on sulphate of alumina are firm. Demand reported light for the current week. The commercial grades are currently quoted at from $1.15 to $1.25; iron free at from $1.75 to $1.85 per 100 pounds. All prices in bags, carlots, f.o.b., works.

SULPHUR—Prices on sulphur are firm and conform to prevailing market levels. Annual contracts are currently quoted at $16 per long ton, f.o.b., mines. Spot and nearby carlots are quoted at $18 per ton.

TALC—Quotations on talc are firm and continue unchanged at prevailing market prices. Domestic talc is currently quoted at from $15 to $21 per ton, at mines. No quotations on imported talc.

MARKET QUOTATIONS

All market quotations, excepting those otherwise designated as official OPA maximum prices, are based on the manufacturers' price level as of October 1-15, 1941; maximum wholesale prices are based on the merchants' maximum prices for stipulated quantities at a quoted price to all customers of a like class, as shown by the merchant's sales records of goods delivered during March, 1942. A merchant's price list in effect in March 1942, showing quotations of actual shipments, will establish the current maximum prices.

Paper

(Delivered New York)

News, per ton—			
Roll, contract	$50.00	●	—
Sheets	58.00	"	—
Kraft—per cwt.—Carload Quantities Zone A, f.o.b. Mill			
Superstandard Wrapping	$5.00	●	—
No. 1 Wrapping	4.75	"	—
Standard Wrapping	4.50	"	—
Standard Bag	4.125	"	—
Tissues—Per Ream—Carlots			
White No. 1	1.12½	"	—
White No. 1 M. G.	1.05	"	—
White No. 1½	1.00	"	—
White No. 2	1.00	"	—
Anti-Tarnish M. G.	.95	"	—
Colored	—	"	—
Kraft	.95	"	—
Manila	.90	"	—
Unbl. Toilet, 1 M.	4.16	"	—
Bleached Toilet	5.70	"	—
Paper Towels Per Case			
Unbleached, Jr.	2.35	"	—
Bleached, Jr.	2.65	"	—
Manila—per cwt.—C l l .			
No. 1 Jute	11.25	●	—
No. 1 Manila Wrapping, 35 lb.	5.50		5.75
No. 2 Manila Wrapping, 35 lb.	5.25	"	5.50
Boards, per ton—			
News	*48.00	●	—
Chip	*45.00	"	—
Sgl. Mla. Ll. Chip	*60.00	"	—
White Pat. Coated	*75.00	"	—
Kraft Liners 50 lb.	*60.00	"	—
Binders Boards	84.00	"	116.00

*OPA Base Prices per 10 tons. Less than 10 tons but over 3 tons, add $2.50; three tons or less, add $5; regular 35-39 basis, add $5.; basis 40-49, add $2.50; basis 91-100, add $2.50; basis 101-120, add $5.

The following are representative of distributors' resale prices:

Rag Content Bonds and Ledgers—White, Assorted Items.
Delivered in Zone 1:

	Bonds		Ledgers	
100% Rag Ext. No. 1	$39.10	@$46.00	$40.25	@$47.25
100% Rag	32.20 "	37.75	33.35 "	39.25
85% Rag	.... "	....	29.90 "	35.00
75% Rag	23.00 "	27.00	24.15 "	28.25
65% Rag	.... "	...	22.80 "	27.75
50% Rag	18.70 "	22.75	19.90 "	24.25
25% Rag	16.40 "	20.00	17.55 "	21.50

Colors at $1.00 cwt. extra.

Sulphite Bonds and Ledgers—White, Assorted Items.
Delivered in Zone 1:

	Bonds		Ledgers	
No. 1	$10.55	@$12.75	$11.70	@$14.25
No. 2	9.65 "	11.75	10.80 "	13.25
No. 3	9.20 "	11.25	10.35 "	12.50
No. 4	8.90 "	10.75	10.05 "	12.25

Colors $1.00 cwt. extra.

Free Sheet Book Papers—White, Cased Paper

Delivered in Zone 1

No. 1 Glossy Coated	$13.65	@$13.9
No. 2 Glossy Coated	12.40 "	14.0
No. 3 Glossy Coated	11.60 "	13.25
No. 4 Glossy Coated	11.15 "	12.7
No. 1 Antique (watermarked)	10.25 "	11.75
No. 2 Offset	9.60 "	11.00
A Grade E. F.	9.35 "	10.75
A Grade S. & S. C.	9.60 "	11.00
B Grade E. F.	8.85 "	10.25
B Grade S. & S. C.	9.10 "	10.50
C Grade E. F.	8.55 "	9.75
C Grade S. & S. C.	8.80 "	10.00
D Grade E. F.	8.25 "	9.50
D Grade S. & S. C.	8.50 "	9.7

Ivory & India at $.50 cwt. extra

Wood Pulp

OPA Maximum Prices and Canadian Manufacturers Prices, Less Freight to Destination.

Bl. Softwood Sulphite		$76.00
Unbl. Softwood Sulphite	64.00	@ 66.00
Bl. Hardwood Sulphite		73.50
Unbl. Hardwood Sulphite		63.50
Bl. Mitscherlich		81.00
Unbl. Mitscherlich		72.00
N. Bleached Sulphate		86.00
S. Bleached Sulphate		79.00
N. Semi-Bleached Sulphate		82.00
S. Semi-Bleached Sulphate		75.00
N. Unbl. Sulphate		73.00
S. Unbl. Sulphate		63.50
Bl. Soda		66.00
Unbl. Soda		62.00
Groundwood		46.00

Transportation Allowances

Applying to Producers of Wet Wood Pulp.

	Below 80% Air Dry Weight
Northeast	$13.50
Lake Central	13.50
Southern	16.00
West Coast (in area)	10.50
West Coast (out area)	16.50
	80%-80% Air Dry Weight
Northeast	$11.50
Lake Central	11.50
Southern	14.00
West Coast (in area)	9.50
West Coast (out area)	13.50

Applying to Producers of Dry Wood Pulp.

	Above 80% Air Dry Weight
Northeast	$8.50
Lake Central	8.50
Southern	11.00
West Coast (in area)	7.50
West Coast (out area)	13.50

Should freight charges actually exceed these allowances, the difference may be added to the maximum prices

Domestic Rags

New Rags

(Prices to Mill f. o. b. N. Y.)

Shirt Cuttings—			
New White, No. 1	8.00	●	8.25
Silesias No. 1	4.50	"	4.75
New Unbleached	8.00	"	8.25
Blue Overall	5.75	"	6.00
Fancy	3.00	"	3.25
Washables	2.50	"	2.75
Mixed Khaki Cuttings	2.50	"	2.75
O. D. Khaki Cuttings	3.00	"	3.15

Old Rags

White, No. 1—			
Repacked	*3.80	"	—
Miscellaneous	*3.20	"	—
White, No. 2—			
Repacked	*2.90	"	—
Miscellaneous	*2.65	"	—
Thirds and Blues—			
Repacked	*2.20	"	—
Miscellaneous	*1.80	"	—
Roofing Rags—			
No. 1	*1.55	"	—
No. 3	*1.45	"	—
No. 3 (bagging)	*1.35	"	—
No. 4	*1.35	"	—
No. 5A	*1.35	"	—
Old Manila Rope	5.75	"	—

OPA Maximum Prices.

Foreign Rags

All prices nominal

New Rags			
New Dark Cuttings	2.25	@	2.40
New Mixed Cuttings	2.00	"	2.20
New Light Silesias	5.50	"	5.75
Light Flannelettes	5.50	"	5.75
New White Cuttings	7.00	"	7.50
New Light Oxfords	4.00	"	4.50
New Light Prints	3.00	"	3.25
Old Rags			
No. 1 White Linens	7.50	"	8.50
No. 2 White Linens	6.50	"	7.50
No. 3 White Linens	4.50	"	—
No. 4 White Linens	2.25	"	3.25
No. 1 White Cotton	4.25	"	4.75
No. 2 White Cotton	3.25	"	3.75
No. 3 White Cotton	2.50	"	3.00
No. 4 White Cotton	1.90	"	2.20
Extra Light Prints	2.00	"	2.40
Ord. Light Prints	1.75	"	2.15
Med. Light Prints	1.55	"	1.95
Dutch Blue Cottons	2.25	"	2.50
French Blue Linens	3.00	"	—
Checks and Blues	2.00	"	—
Linsey Garments	1.90	"	2.00
Dark Cottons	1.50	"	1.60
Old Shopperies	1.30	"	1.45
New Shopperies	1.45	"	1.50
French Blues	2.25	"	2.50

BAGGING

(Prices to Mill, f. o. b. N. Y.)

Gunny No. 1—			
Foreign	Nominal		
Domestic	4.00	@	4.25
Wool Tares, light	4.25	"	4.50
Wool Tares heavy	4.50	"	4.75
Bright Bagging	4.50	"	4.85
Manila Rope—			
Foreign	—	"	—
Domestic	*5.75	"	—
Jute Threads	4.25	"	4.75
Sisal Strings	3.25	"	3.75
Mixed Strings	1.10	"	1.20

*OPA Maximum Price.

Old Waste Papers

(F. o. b. New York)

OPA Maximum Prices

No. 1 Hard White Envelope Cuts, one cut	3.37½	@	—
No. 1 Hard White Envelope Cuts	3.12½	"	—
No. 1 Hard White Shavings, unruled	2.87½	"	—
No. 1 Hard White Shavings, ruled	2.50	"	—
Soft White Shavings, one cut	2.87½	"	—
No. 1 Soft White Shavings	2.50	"	—
Soft White Shavings, Misc.	2.15	"	—
No. 1 Fly Leaf Shavings	1.67½	"	—
No. 2 Fly Leaf Shavings	1.12½	"	—
No. 1 Groundwood Fly Leaf Shavings	1.25	"	—
No. 2 Mixed Groundwood Fly Leaf Shavings	.90	"	—
Mixed Colored Shavings	.75	"	—
Mixed Groundwood Colored Shavings	.90	"	—
Overissue Magazines	1.67½	"	—
No. 1 Heavy Books & Magazines	1.57½	"	—
Mixed Books	.85	"	—
No. 1 White Ledger	2.17½	"	—
No. 2 Mixed Ledger, colored	1.87½	"	—
New Manila Envelope Cuttings, one cut	2.87½	"	—
New Manila Envelope Cuttings	2.65	"	—
Extra Manilas	1.85	"	—
Mixed Kraft, Env. & Bag Cuttings	2.75	"	—
Kraft Envelope Cuttings	3.25	"	—
Triple Sorted, No. 1 Brown Soft Kraft	2.50	"	—
New 100% Kraft Corrugated Cuttings	2.25	"	—
No. 1 Assorted Old Kraft	1.75	"	—
New Jute Corrugated Cuttings	.90	"	—
Old Kraft Corrugated Containers	1.50	"	—
Box Board Cuttings	.72½	"	—
White Blank News	1.65	"	—
Overissue News	.85	"	—
No. 1 News	.75	"	—
No. 1 Mixed Paper	.70	"	—
Old Corrugated Containers	.82½	"	—
Mill Wrappers	.85	"	—

Twines

(F. o. b. Mill)

(Soft Fiber)

Coarse Polished—			
India	.21	@	—
White Hemp	.21	"	—
Fine Polished—			
Fine India	.26	"	—
Unpolished—			
Box	.17½	"	—
Paper Makers	.17	"	—
Tube Rope	.19	"	—
Wall Paper	.20½	"	—
Wrapping	.23	"	—
Soft Fiber Rope	.19	"	—
Cotton	.25	"	—
(Hard Fiber)			
Medium Java	.18	"	—
Mex. Sisal	.16	"	—
Manila	—	"	—

PHILADELPHIA

Domestic Rags (New)

(Price to Mill, f. o. b. Phila.)

Shirt Cuttings—			
New White No. 1	.07½	@	.07½
New White No. 2	.04½	"	.05
Light Silesias	.04½	"	.04¾
Silesias, No. 1	.04	"	.04¼
Black Silesias, soft	.03¼	"	.04
New Unbleached	.07¼	"	.07½
Washable Prints	.03¼	"	.03½
Washable No. 1	.02	"	.02¼
Blue Overall	.04½	"	.05½
Cottons—According to grades—			
Washable shredding	—	"	.01¼
Fancy Percales	.03¼	"	.03½
New Black Soft	.02¾	"	.03
New Dark Seconds	1.75	"	2.00
Khaki Cuttings—			
No. 1 O. D.	.03	"	.03¼
No. 2 Mixed	.02¼	"	.02½
Corduroy	.01¼	"	.02¼
New Canvas	.04¼	"	.05¼
New Black Mixed	—	"	.02½

Domestic Rags (Old)

White No. 1—Repacked	3.80	"	—
White No. 2—Repacked	2.90	"	—
Miscellaneous No. 1	3.20	"	—
Miscellaneous No. 2	2.65	"	—
Thirds and Blues—			
Miscellaneous	1.80	"	—
Repacked	2.20	"	—
Black Stockings—			
(Export)	Nominal		
Roofing Stock—			
Foreign No. 1	Nominal		
Domestic No. 1	1.55	"	—
Domestic No. 2	1.45	"	—
Roofing Bagging	1.35	"	—
Old Manila Rope	5.75	"	—

Bagging

(F. o. b. Phila.)

Gunny No. 1—			
Foreign	Nominal		
Domestic	3.00	"	3.50
Sisal Rope	3.75	"	—
Mixed Rope	.75	"	1.00
Scrap—			
No. 1	3.25	"	3.50
No. 2	1.75	"	1.80
Wool Tares, heavy	4.00	"	4.25
No. 1 New Light Burlap	3.90	"	4.00
New Burlap Cuttings	3.75	"	4.00

Old Papers

(F. o. b. Phila.)

OPA Maximum Prices

No. 1 Hard White Envelope Cuts, one cut	3.37½	"	—
No. 1 Hard White Shavings, unruled	2.50	"	—
Soft White Shavings, one cut	2.87½	"	—
White Blank News	1.65	"	—
Soft White Shavings, Misc.	2.15	"	—
No. 1 White Ledger	2.17½	"	—
No. 2 Ledger, colored	1.87½	"	—
No. 1 Heavy Books & Magazines	1.57	"	—
Overissue Magazines	1.67½	"	—
New Manila Envelope Cuttings	2.65	"	—
No. 1 Assorted Old Kraft	1.75	"	—
No. 1 Mixed Paper	.70	"	—
Box Board Cuttings	.72½	"	—
Jute Corrugated Cuttings	.90	"	—
Overissue News	.85	"	—
No. 1 News	1.00	"	—

BOSTON

Old Papers

(F. o. b. Boston)

OPA Maximum Prices

No. 1 Hard White Shavings, unruled	2.87½	@	—
No. 1 Hard White Shavings, ruled	2.50	"	—
Soft White Shavings, Misc.	2.15	"	—
No. 1 Fly Leaf Shavings	1.67½	"	—
No. 2 Fly Leaf Shavings	1.12½	"	—
No. 1 Groundwood Fly Leaf Shavings	1.25	"	—
No. 2 Groundwood Fly Leaf Shavings	.90	"	—
Mixed Colored Shavings	.75	"	—
New Manila Envelope Cuts, one cut	2.87½	"	—
Hard White Envelope Cuts, one cut	3.37½	"	—
Triple Sorted No. 1 Brown Soft Kraft	2.50	"	—
Mixed Kraft Env. & Bag Cuttings	2.75	"	—
Kraft Envelope Cuttings	3.25	"	—
No. 1 Heavy Books & Magazines	1.57	"	—
New Manila Envelope Cuts, one cut	2.87½	"	—
New Manila Envelope Cuttings	2.65	"	—
White Blank News	1.65	"	—
No. 1 Assorted Old Kraft	1.75	"	—
No. 1 Mixed Paper	.70	"	—
Overissue News	.85	"	—
Box Board Cuttings	.72½	"	—
New Corrugated Cuttings, Kraft	2.25	"	—
Old Corrugated Containers	1.00	"	—
Jute Corrugated Cuttings	1.07½	"	—

Bagging

(F. o. b. Boston)

Gunny Bagging—			
Foreign	(nominal)		
Domestic	3.50	@	4.00
Sisal Rope	4.50	"	4.75
Mixed Rope	1.35	"	1.50
Transmission Rope—			
Foreign	(nominal)		
Domestic	3.00	"	3.50
Manila Rope—			
Foreign	(nominal)		
Domestic	5.75	"	—
Soft Jute Rope	4.75	"	5.25
Jute Carpet Threads	3.25	"	3.50
Bleachery Burlap	8.50	"	9.00
Scrap Burlap—			
Foreign	(nominal)		
Domestic	3.50	"	3.75
Scrap Sisal	4.50	"	4.75
Scrap Sisal for Shredding	—	"	.04¾
Wool Tares—			
Foreign	(nominal)		

Domestic	5.00	"	5.75
Aust. Wool Pouches	5.10	"	5.25
New Burlap Cuttings	5.00	"	5.25
Heavy Baling Bagging	4.25	"	4.75
Paper Mill Bagging	2.75	"	3.00
No. 2 Bagging	1.35	"	—*

*OPA Maximum Price.

Domestic Rags (New)

(F. o. b. Boston)

Shirt Cuttings—			
New Light Prints	.04½	@	.04¾
Fancy Percales	.04¼	"	.05
New White No. 1	.06¼	"	.06½
New Light Flannelettes	.05½	"	.06
Canton Flannels, Bleached	.06	"	.06½
Underwear Cutters, Bleached	.06	"	.06½
Underwear Cutters, Unbleached	.05¾	"	.06
Silesias No. 1	.06	"	.06¼
New Black Silesias	.03	"	.03½
Red Cotton Cuttings	.03½	"	.04
Soft Unbleached	.06½	"	.06¾
Blue Cheviots	.05½	"	.06
Fancy	.02¾	"	—
Washable	.02¾	"	—
Khaki Cuttings	.02¾	"	.03
O. D. Khaki	.03½	"	.03¾
Corduroy	.03¼	"	.03½
New Canvas	.06¼	"	.06¾
B. V. D. Cuttings	.06¼	"	.06¾

Domestic Rags (Old)

(F. o. b. Boston)

White No. 1—			
Repacked	3.80	@	—*
Miscellaneous	3.20	"	—*
White No. 2—			
Miscellaneous	2.65	"	—*
Twos and Blues, Repacked	2.20	"	—*
Old Blue Overalls	2.25	"	2.50
Thirds and Blues, Repacked	2.20	"	—*
Miscellaneous	1.80	"	—*
Black Stockings	3.50	"	4.00
Roofing Stock—			
No. 1	1.55	"	—*
No. 2	1.45	"	—*
No. 3	1.35	"	—*
No. 4	1.35	"	—*
No. 5, Quality A	1.35	"	—*
Quality B	1.20	"	—*
Quality C	.95	"	—*
Old Manila Rope	5.75	"	—

*OPA Maximum Prices.

Foreign Rags

(F. o. b. Boston)

Canvas	(nominal)
Dark Cottons	(nominal)
Dutch Blues	(nominal)
New Checks and Blues	(nominal)
Old Fustians	(nominal)
Old Linsey Garments	(nominal)
New Silesias	(nominal)

CHICAGO

Waste Paper

(F. o. b. Chicago)

OPA Maximum Prices.

Shavings—			
No. 1 Hard White Envelope Cuts, one cut	3.37½	"	—
No. 1 Hard White Shavings, unruled	2.50	"	—
No. 1 Soft White Shavings	2.50	"	—
No. 1 White Ledger	2.17½	"	—
No. 1 Heavy Books & Magazines	1.57	"	—
White Blank News	1.65	"	—
Mixed Kraft Env. & Bag Cuttings	2.75	"	—
No. 1 Assorted Old Kraft	1.75	"	—
Overissue News	.85	"	—
No. 1 News	.75	"	—
No. 1 Mixed Paper	.70	"	—
No. 1 Roofing Rags	1.55	"	—
No. 1 Roofing Bags	1.45	"	—